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HUMANS PRODUCED FIRE
'ONE MILLION' YEARS AGO

FRONTAL
LOBOTOMIES
AND DARWINISM

THE FALL OF SATAN
AFFIRMED IN
EZEKIEL 28?

GALAXIES AND
QUASAR FAMILIES:
SURPRISING PHYSICAL LINK

HOMO ERECTUS
AND MODERN HUMAN ORIGINS

JOURNAL OF CREATION

An international journal devoted to the presentation and discussion of technical aspects of the sciences such as geology, biology, astronomy, etc., and also geography, archaeology, biblical history, philosophy, etc., as they relate to the study of biblical creation and Noah's Flood.

COVER: Cast of the adult *Homo erectus* cranium Sangiran 17 from Java, Indonesia

IMAGE: Peter Line

Editorial correspondence should be addressed to:

The Editor
Journal of Creation
Creation Ministries International
PO Box 4545
Eight Mile Plains
QLD 4113
AUSTRALIA

Email: journal@creation.com

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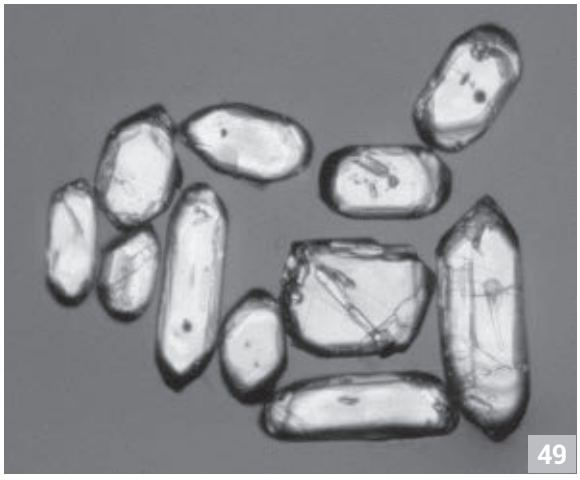
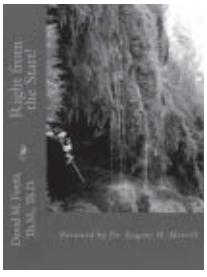
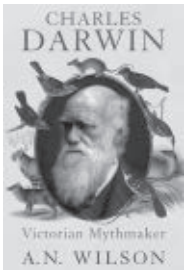
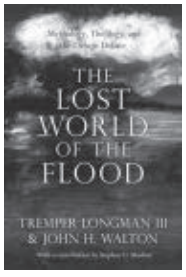
COUNTERING THE CRITICS

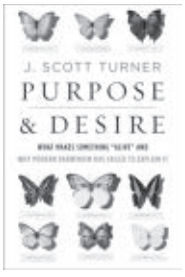


The high percentage of helium in radioactive zircon crystals is just one of over 100 pieces of evidence that the world is young.









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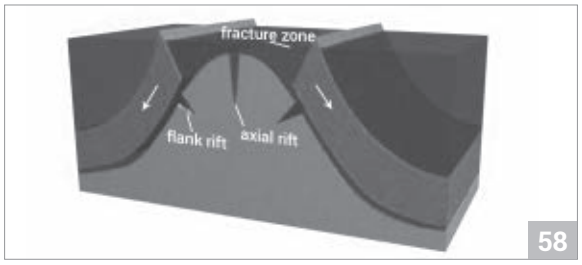

Can the Hydroplate Theory address tectonic features such as oceanic trenches all around the earth?

VIEWPOINT

Evolutionary theory presents the family Araucariaceae as being a group of dinosaur-age plants that are on a path to extinction.

ESSAYS

ABOUT US

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Confirmed: physical association between parent galaxies and quasar families

John G. Hartnett

In a paper just published[1] that looked for an association between putative parent galaxies and pairs of quasars,[2–4] the authors found many such quasar families, suggesting that the association is real, and not just coincidental. They used the Sloan Digital Sky Survey (SDSS) data release 7 and the 2MASS (Two Micron All Sky Survey) Redshift Survey (2MRS) Ks ≤ 11.75 mag data release to *test for the physical association of candidate companion quasars with putative parent galaxies* by virtue of Karlsson periodicity in quasar redshifts.

Karlsson proposed that quasars have an intrinsic non-cosmological redshift component which comes in discrete values (z_K = 0.060, 0.302, 0.598, 0.963, 1.410, ...). However, to properly detect any physical association, the candidate quasar redshift must be transformed into the rest frame of its putative parent galaxy's redshift. (This assumes either the parent galaxy redshift is cosmological or, if not, that it is Hubble law related but not due to expansion of the universe.) Then the transformed redshift of the candidate companion quasar is associated with the closest Karlsson redshift, z_K, so that the remaining redshift velocity component—the putative velocity of ejection away from the parent object—can be obtained. In this manner it is possible to detect a physical association, even in the case where parent galaxies have high redshift values. If this process is neglected, no association may be found. Such was done in several papers, applied to large galaxy/quasar surveys, claiming to debunk the Arp hypothesis.

In this new paper, the authors used the method described above, and the detected correlation was demonstrated to be much higher than just a random association. Many such associations were found. As an example, in one instance, within one 4 degree area on the sky, seven quasar families were found to be statistically correlated with parent galaxies (figure 1). The probability of this occurring by random chance was calculated as follows:

> "For a binomial distribution ... the probability of 7 hits for one 4 square degree area is … = 1.089 × 10^{-9}. Under these conditions, the detection of 7 families with this particular constraint set is *extraordinary* [emphasis added]."

Generally, the results of this paper are a confirmation of the quasar family detection algorithm described by Fulton and Arp,[5] which was used to analyze the 2dF Galaxy Redshift Survey (2dFGRS) and the 2dF Quasar Redshift Survey (2QZ) data sets. This means that using the SDSS and 2MRS data sets the correlation found in Fulton and Arp (2012) is further strengthened.

This means that to a very high probability, much higher than a random association, certain quasars are physically associated with lower redshift galaxies. The quasars are found in pairs or higher multiples of two. The results further imply that these quasar redshifts indicate a real ejection velocity component and a

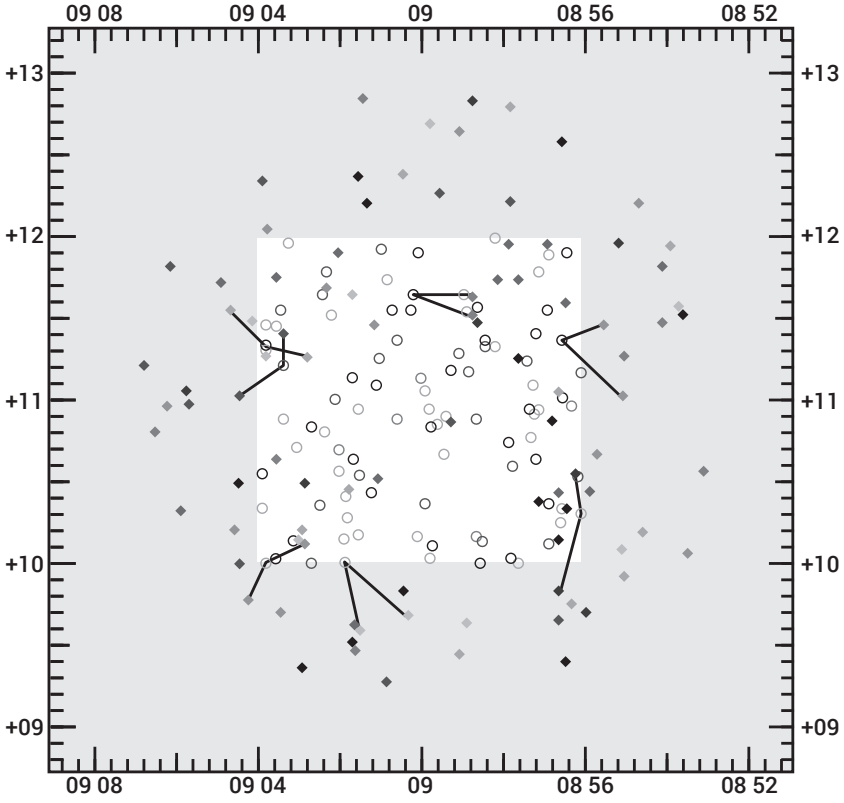


Figure 1. Detected families in a 4 square degree area centred at 09h00m00s+11d00m00s. The open circles are galaxies, the filled diamonds are quasars, with lines connecting each galaxy to its detected quasar family members. The object shades indicate stepped redshift increase from light to dark over the redshift range 0.0 ≤ z ≤ 5.5. The central unshaded area shows the galaxies under examination, and the entire area shows the candidate companion quasars.

large intrinsic non-velocity or non-cosmological redshift component.

The results described in this new paper[1] conclude that:

> "... similarly, certain SDSS quasars are physically associated with lower redshift SDSS galaxies and separately with lower redshift 2MRS galaxies; at least some quasars of very different redshift are physically associated with the same nearby galaxy; with the available typed galaxy data, quasar families occur with approximately equal frequency around nearby ellipticals and lenticulars versus around nearby spirals and irregulars, and quasar families occur somewhat more frequently around nearby unbarred spirals than around nearby barred spirals."
>
> "When analyzed separately, the bright and faint quasars maintain high and comparable detection significance around both nearby and distant galaxies, suggesting that gravitational lensing is an unlikely physical explanation for the signal that we detect."
>
> "A quasar excess exists at Karlsson redshifts around the 2dF, SDSS, and 2MRS galaxies."

Conclusion

What does all this mean for biblical creation? Number one, it is strongly critical of the big bang hypothesis that all stars and galaxies result from the early big bang universe. This describes a scenario of quasars being ejected from active parent galaxies in a hierarchical process. If quasars are associated with parent galaxies, which have much smaller redshifts than the associated quasars, then that changes the whole story of the alleged evolution of the universe. Many quasars are more local than at enormous cosmological distances. That is, their large redshifts do not indicate a measure of distance. Again, this brings the standard big bang cosmology into conflict. How do you explain this from a big bang perspective? From a biblical creation perspective it is straightforward: God created the galaxies on Day 4 of Creation Week using this hierarchical process, where quasars are ejected from the active hearts of their parents. And we are observing, now, the results of that process.

References

1. Fulton, C.C., Arp, H.C., and Hartnett, J.G., Physical association and periodicity in quasar families with SDSS and 2MRS, *Astrophysics and Space Science* **363**:134, 2018.
2. Hartnett, J.G., Big-bang-defying giant of astronomy passes away, creation.com/halton-arp-dies, 31 December 2013.
3. Hartnett, J.G., The heavens declare a different story! *J. Creation* **17**(2):94–97, 2003; creation.com/the-heavens-declare-a-different-story.
4. Hartnett, J.G., Quantized quasar redshifts in a creationist cosmology, *J. Creation* **18**(2):105–113, 2004; creation.com/images/pdfs/tj/j18_2/j18_2_105-113.pdf.
5. Fulton, C.C. and Arp, H.C., The 2dF Redshift Survey. I. Physical association and periodicity in quasar families, *Astrophys. J.* **754**:134, 2012; iopscience.iop.org/article/10.1088/0004-637X/754/2/134/meta.

Tephra and inflated ice core ages

Jake Hebert

Creation scientists have long argued that uniformitarians are assigning far too much time to the deep ice cores of Antarctica and Greenland. Since the ice sheets started forming during the post-Flood Ice Age, these ice sheets can be no more than 4,500 years old.[1] And yet uniformitarian scientists routinely assign six-figure ages to those cores.[2–6]

Because of low snowfall, visible (and countable) layers are generally not preserved in the deep Antarctic cores.[7,8] Hence uniformitarians rely on age-depth models which assume the heights of the ice sheets have been constant or nearly constant for vast ages.[9] This assumption greatly simplifies the mathematics, but it is a source of error since it ignores the ice sheet's time of formation. This error can safely be ignored only if the ice sheet's time of formation is negligible compared to the total time the ice sheet has been in existence.

Uniformitarians acknowledge that thick ice sheets can form in 10,000 years or less, even with the relatively low snowfall rates assumed by uniformitarian models.[10,11] With greater and more widespread snowfall during the post-Flood Ice Age, this time of formation could plausibly be reduced to just hundreds or a few thousands of years. If the ice sheets have only been in existence for 4,500 years, this time of formation cannot be ignored when assigning ages to the cores. But if the ice sheet is millions of years old, then this time of formation *can* safely be neglected. Hence, these age models implicitly assume an old earth.

The Greenland ice cores would seem to present a stronger argument for an old earth. Their ages were

supposedly obtained by 'simple' counting of visible layers. However, creation scientists have plausibly argued that uniformitarians are greatly over-counting the true number of annual layers, although space does not permit here a detailed discussion.[1,12,13]

So deep ice cores, despite popular perception, are not airtight arguments for an old earth. Moreover, one might occasionally expect to find positive evidence for the youthfulness of the ice sheets.

Tephra and 'annual' ice core layers

Science popularizer and creation opponent Bill Nye recently highlighted (surely unwittingly!) evidence that presumed 'annual' layers within the Greenland ice sheet are not necessarily annual after all. Ironically, this evidence, which involved tephra (volcanic ash and debris), was featured in a recent documentary which denigrated creation science.[14]

Likewise, in 2010 glaciologists described three layers of tephra discovered within the deepest parts of the Vostok and EPICA Dome C cores.[15] These are thought to be the oldest volcanic deposits ever found within the ice cores. One layer was located at a depth of 2,632 m (assigned age of 358 ka) within the EPICA Dome C (EDC) core. Three others were identified in the Vostok ice core. One was located at a depth of 3,288 m (assigned age of 406 ka). Two were located about a few centimetres apart from one another at a depth of 3,311 m (assigned age of 414 ka). However, the scientists thought that these two were actually the same tephra layer that had been folded by movement of the ice.

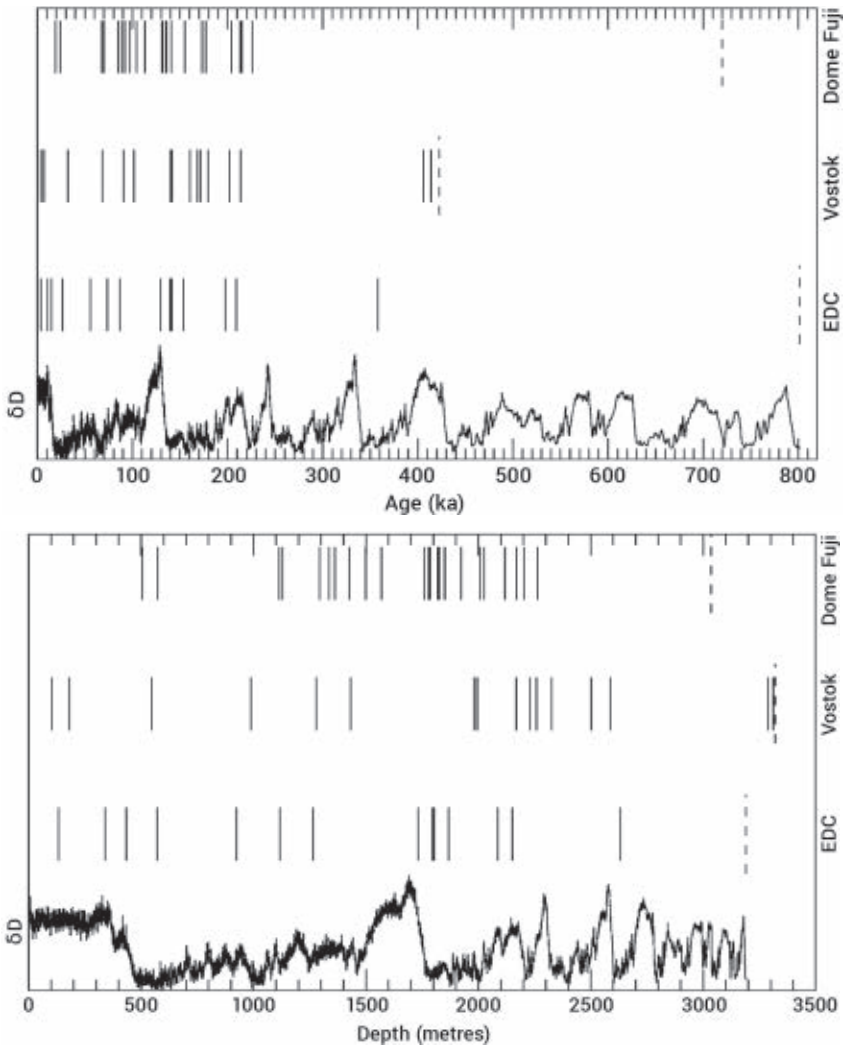


Figure 1. Tephra layers in the Antarctic Dome Fuji, Vostok, and EPICA Dome C cores, along with the (relative) delta deuterium signal from EPICA Dome C, as a function of uniformitarian age assignment (above) and depth (below). Dashed lines indicate greatest approximate ages/depths of core sections that were inspected for tephra layers. Dark tephra bands indicate multiple, closely spaced tephra layers. Constructed using data from references 4, 5, 6, 15, and 17. Not shown are two 'extraterrestrial' dust layers between 400 and 500 ka in the Dome Fuji and EPICA Dome C cores.

The scientists noted the apparent infrequency of tephra layers within the deepest core sections:

> "A striking feature emerging from our study is that the frequency of visible tephra in the Vostok and EDC cores decreases dramatically in the ice older than ca 220 ka (Fig. 5). The last [i.e. most recent] 220-ka sections of both records contain about a dozen discrete tephra layers while only one event is identified at EDC and two at Vostok in the interval 220–414 ka, encompassing more than two complete climate cycles. Tephra layers even disappear from 414 to 800 ka, i.e. the bottom of the EDC core."[16]

They noted that this 'dramatic' drop in visible tephra layers was also apparent in the deep Dome Fuji core (figure 1a). Although dozens of tephra layers were visible in the upper part of the core,[17] only two such tephra layers were visible in the deep part of the Dome Fuji core, thought to represent the time from 230,000 to 700,000 years ago.[16] Because the Dome Fuji core is about 1,500 to 2,000 km from the Vostok and Dome C cores, they concluded that the dearth of visible tephra layers was not an artefact but a 'regional pattern'. Although they acknowledged that not all volcanic eruptions necessarily deposit tephra on the ice sheets, and that not all tephra

layers are preserved, they concluded that "these factors likely act randomly at the long timescale of our observations, and were hardly responsible for the systematic absence of old volcanic layers at the different drilling sites".[16] They also concluded that the lack of visible tephra layers could *not* be blamed on thinning of the ice deep within the cores, nor could it be explained by changes in atmospheric transport of aerosols during the Pleistocene. They concluded that this apparent decrease in tephra frequency might be due to less intense volcanic activity in the South Sandwich Islands in the distant past. However, this would require *greatly* reduced volcanic activity. In the case of the Dome Fuji core, ~500,000 years would have elapsed with no apparent tephra fallout!

Post-Flood Ice Age: another possibility

Of course, the creation model provides another possibility. Because uniformitarian age-depth models (incorrectly) assign vast ages to the greatest depths of the long Antarctic cores, this results in an apparent decrease in the frequency of tephra layers at greater core depths. Of course, this is exactly what is observed.

In fact, when the tephra layers are plotted as a function of depth, rather than time, the spacing between the deepest tephra layers is not nearly as pronounced (figure 1b), although tephras are generally still absent from the very deepest core sections. Heavy snowfall early in the post-Flood Ice Age, with decreasing snowfall at later times, might cause volcanic eruptions to appear somewhat less frequent at the greatest depths. It may be that this observed pattern is the result of both factors.

Conclusion

The Vostok, EPICA Dome C, and Dome Fuji cores are the *only* three deep Antarctic cores with assigned ages greater than 400,000 years whose tephra layers have been thoroughly studied, and all three cores show a dramatic decrease in the apparent frequency of their deepest tephra layers. Coincidence, or an indication of a systematic error in uniformitarian age models? This apparent decrease of volcanic tephra layers is *exactly* what one would expect if uniformitarian age models are assigning hundreds of thousands of years of fictitious time to the deep core sections.

Skeptics have long seen the deep ice cores as an unanswerable argument for an old earth. However, creation scientists have already provided a plausible defence against this claim.[1,12,13] Creation researchers should now go on 'offence', working to show that the creation model provides a superior framework for interpreting the ice core data. These deep Antarctic tephra layers are a step in that direction.

References

1. Oard, M.J., *The Frozen Record*, Institute for Creation Research, Santee, CA, 2005.
2. Meese, D.A. *et al.*, The Greenland Ice Sheet Project 2 depth-age scale: methods and results. *J. Geophysical Research* **102**(C12):26411–26423, 1997.
3. Yau, A.M., *et al.*, Reconstructing the last interglacial at Summit, Greenland: insights from GISP2, *PNAS USA* **113**(35):9710–9715, 2016.
4. Basile, I. *et al.*, Volcanic layers in Antarctic (Vostok) ice cores: source identification and atmospheric implications, *J. Geophysical Research* **106**(D23):31915–31931, 2001.
5. Narcisi, B. *et al.*, Characteristics and sources of tephra layers in the EPICA-Dome C ice record (East Antarctica): implications for past atmospheric circulation and ice core stratigraphic correlations, *Earth and Planetary Science Letters* **239**:253–265, 2005.
6. Jouzel, J. *et al.*, Orbital and millennial Antarctic climate variability over the past 800,000 years, *Science* **317**(5839):793–797, 2007.
7. Palerme, C. *et al.*, How much snow falls on the Antarctic ice sheet? *The Cryosphere Discussions* **8**:1279–1304, 2014.
8. Dating by forward and inverse modelling, Centre for Ice and Climate, Niels Bohr Institute, iceandclimate.nbi.ku.dk/research/strat_dating/forward_inv_modelling/, accessed 3 May 2018.
9. Cuffey, K.M. and Paterson, W.S.B., *The Physics of Glaciers*, 4th edn, Butterworth-Heinemann, Burlington, MA, p. 617, 2010.
10. Wilson, R.C.L., Drury, S.A., and Chapman, J.L., *The Great Ice Age: Climate change and life* (2005 electronic version), Routledge and the Open University, London and New York, p. 69, 2005.
11. Caltech Division of Geological and Planetary Sciences, class lecture notes, web.gps.caltech.edu/classes/ese148a/lecture18b.pdf, accessed 3 May 2018.
12. Hebert, J., Ice cores, seafloor sediments, and the age of the earth, part 2, *Acts & Fac*ts **43**(7):12–14, 2014.
13. Hebert, J., Thick ice sheets: how old are they really? *Acts & Facts* **44**(6):15, 2015.
14. Hebert, J., Bill Nye, PBS highlight young-earth evidence, icr.org/article/bill-nye-PBS-young-earth, 27 April 2018.
15. Narcisi, B., Petit, J.R., and Delmonte, B., Extended East Antarctic ice-core tephrostratigraphy. *Quaternary Science Reviews* **29**:21–27, 2010.
16. Narcisi *et al.*, ref. 15, p. 25.
17. Kohno, M., Fuji, Y., and Hirata, T., Chemical composition of volcanic glasses in visible tephra layers found in a 2503 m deep ice core from Dome Fuji, Antarctica, *Annals of Glaciology* **39**:576–584, 2004.

DNA barcodes show gaps between species and support recent common bottleneck

Yingguang Liu

A recent publication by Stoeckle and Thaler in *Human Evolution* challenges biologists to reconsider the history of life on earth.[1] The paper, entitled *Why Should Mitochondria Define Species?*, is based on analyses of DNA barcoding data accumulated over a decade. The authors concluded that 1) there are large gaps between genetic sequences of animal species; 2) all animal species expanded from small founding populations "within the last one to several hundred thousand years". The paper has drawn some comments in popular media. How do we view these findings from a creationist perspective?

Is the gene representative?

The data used consisted of relatively short DNA sequences, and were originally not intended for studying phylogenetic relationships between species but for DNA barcoding (the identification of species), i.e. similar to the forensic analysis carried out to identify individuals. However, as millions of sequences have been deposited, Stoeckle and Thaler were able to mine the data for phylogenetic insight.

DNA barcoding in animals is most often accomplished by analyzing the mitochondrial cytochrome oxidase subunit I (COI). COI is a molecule that directly works with oxygen gas to burn food. It is located in subcellular structures called mitochondria. While most DNA in animal cells resides in the nucleus, a small fraction is found in mitochondria (figure 1). Compared to nuclear genes, small mitochondrial DNA (mtDNA) molecules are inherited via the maternal line only. They are also more stable and more similar among species, which is why they are conveniently used for DNA barcoding. This homologous nature of mtDNA lends itself well to phylogenetic analyses, which is why Stoeckle and Thaler described it as 'commeasurable'. Although the COI gene constitutes only 5% of the mitochondrial genome, and less than a millionth of the total genome of a human, phylogenetic trees based on this gene are congruent with trees based on the entire mitochondrial genome. Clustering of the COI sequences also corresponds well with holistic classifications produced by taxonomical experts, and creationist Nathaniel Jeanson finds mtDNA trees accurate and useful.[2]

All animal species experienced a recent bottleneck?

One surprising finding of the paper is that variation of the COI gene within humans and among different animal species (intraspecific variance) are similar, with average pairwise differences between 0.0% and 0.5% (0.1% for humans). Variations within species are due to mutations. Stoeckle and Thaler argued that these mutations do not affect reproductive fitness (i.e. they are neutral mutations) and are free to accumulate over time. Indeed, mutations in mitochondrial genes are more likely to be neutral compared to those in nuclear genes because the mitochondrial gene reading system is simpler and less nuanced than the nuclear system (i.e. there are fewer isoacceptor tRNAs and there is no alternative splicing). Whether the mutations are completely neutral or near neutral, natural selection is unlikely to stop their accumulation.[3]

Accumulation of random mutations can serve as a molecular clock. Even though mutation rates may vary throughout history and across species, the number of mutations is nonetheless a reflection of time. The fact that all animals have accumulated similar numbers of mutations strongly indicates that their populations grew during the same time period. Thus, Stoeckle and Thaler concluded:

> "Namely that the extant population, no matter what its current size or similarity to fossils of any age has expanded from mitochondrial uniformity within the past 200,000 years."

Stoeckle and Thaler proposed "bottlenecks, founder effects, lineage sorting, and gene sweeps" to explain mitochondrial uniformity. By lineage sorting, they meant one form of mitochondrial genome takes over other forms due to random drifting (like random loss of family names in a population), while gene sweep refers to a genetic takeover by strong positive selection. "Lineage sorting is most efficient when the population is small", and genome sweep requires that "the entire population's mitochondrial genome must re-originate from a single mother".

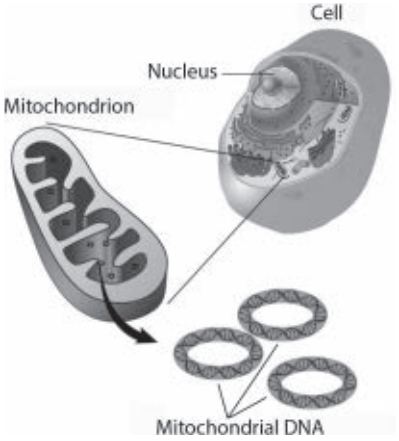


Figure 1. The cell, mitochondria, and mitochondrial DNA

Then the authors commented:

> "Not certain is whether different processes have led to a similar result throughout the animal kingdom or if a single process operates throughout. Occam's razor, the principle of parsimony, suggests that a single explanation should be considered."

Just a few years ago, the same authors were still arguing against this idea:

> "If bottlenecks limit variation, then a universal low ceiling implies recent population crashes for all species. This appears unlikely–almost a Noah's Ark hypothesis–although perhaps long-term climate cycles might cause widespread periodic bottlenecks."[4]

So, they named the elephant in the room! The data neatly fit with a young creation and a global Flood, although it is difficult to distinguish between the founder effect of creation and the bottleneck effect of the Flood, since the two events are not separated by a very long period.

Is the clock accurate?

It is impossible to determine how fast the mitochondrial clock ticked in the past, or if it always ticks at a constant rate, but we can evaluate the timeframe given in the paper based on how the clock was calibrated. Since humans and animals originated at about the same time, Stoeckle and Thaler dated animal species according to accepted human history, which is based on "full genome sequence analysis of thousands of individuals and tens of thousands of mitochondria, paleontology, anthropology, history and linguistics". Fossils played a significant part in the ultimate calibration.[5,6] Jeanson, on the other hand, estimated the age of human mitochondria solely based on observed mutation rates (5–8 mutations per generation) and found that variations of the human mitogenome agree more with a biblical timeframe of ~6,000 years than the generally accepted 200,000 years.[7,8]

Linnaeus versus Darwin

A key finding in the paper is the genetic discontinuity between species. In contrast to the low variance between individuals of the same species, the sequence differences between species are much larger. Stoeckle and Thaler wrote:

> "The clustering of barcodes has two equally important features: 1) the variance within clusters is low, and 2) the sequence gap among clusters is empty, i.e. intermediates are not found."

This is not surprising since a barcode is designed to distinguish between species. The COI gene would not have been successful in bar coding if there were significant sequence overlaps among species. However, Stoeckle and Thaler have a good reason to emphasize this discontinuity. Molecular phylogeny was designed to quantify similarities and differences between organisms, and the nature of the data has always given the impression that differences between taxa are only quantitative. (It is much harder to visualize qualitative differences in DNA and protein sequences than in whole animals.) Since many phylogenetic trees today derive from DNA sequences, molecular evolutionary studies have greatly relied upon them despite their conflicts with paleontology and other inherent discordances arising from their use.[9] However, as DNA barcodes of individual organisms accumulated, Stoeckle and Thaler were able to see that mitochondrial genomic variances are "constrained within narrow parameters".

They correctly went back to Linnaeus and Darwin as they quoted a paper by Aves *et al.*:

> "In a founding document of phylogeography, Avise and colleagues noted the long-standing divide in biology between the intellectual lineages of Linnaeus for whom species are discrete entities and those of Darwin who emphasize incremental change within species leading to new species."[10]

Starting with the *Scala Naturae* (Great Chain of Being) handed down since the days of Aristotle, Carl Linnaeus (1707–1778) wrote his *Systema Naturae*, in which he introduced biological classification and binomial nomenclature. To counteract Linnaeus' conception of discontinuity between taxa, Comte de Buffon (1707–1788) wrote *Histoire Naturelle*, advocating "imperceptible gradations" in nature.[11] The debate between organic continuity and discontinuity continues until today, as Stoekle and Thaler point out:

> "The tight clustering of barcodes within species and unfilled sequence space among them are key facts of animal life that evolutionary theory must explain."

They even proposed a hypothesis for it:

> "The variable distance between the most closely related living species presumably reflects differing numbers of *extinct intermediate sequences* [emphasis added]."

A new evolutionary law?

To Stoeckle and Thaler, extinction is an explanation of the gaps. They mentioned "a new evolutionary law" proposed by Van Valen in 1973.[12] Dubbed the Law of Extinction, it states: "All groups for which data exist go extinct at a rate that is constant for a given group."

The 'law' was mainly derived from fossil records. According to Van Valen, the extinctions were primarily due to ecological interactions between species, so the probability of extinction is independent of the age of the species. Like most others, Van Valen

also believed in constant generation of species.

If no species survive long ages, all species at any point in history should appear new. However, since the law postulates that different taxa go extinct at different rates, it cannot explain why all extant animal species have comparable mitochondrial ages.

Interestingly, the Law of Extinction has gained support from contemporary biology. In his book, *Genetic Entropy*, John Sanford proposes that all species have a finite lifespan, and not due to extrinsic factors but due to random genetic mutations eroding the genome. Without constant generation of new life-forms, Sanford's theory argues against a long history of life.

More is coming?

Stoeckle and Thaler pointed out that there were still 23 phyla of small invertebrate animals where clustering of DNA barcodes was not clear, and they expect better illumination of their history as more barcoding is performed in the future.

Creationists have been trying to define the biblical concept of 'created kinds' (baramins), from which all species—extinct and extant—descended. While Stoekle and Thaler showed gaps between species of various genera, they also gave examples where interspecific variances are relatively low, such as the bear (*Ursus*) genus, which is explainable with evidences of hybridization of derivatives from one created kind. It seems that DNA barcoding data may also help further development of baraminology.

Conclusion

Stoeckle and Thaler courageously challenge Darwinian gradualism. Although the absolute ages of animal species are questionable, the consistently young mitochondrial ages are consistent with either a recent creation, or a genetic bottleneck conferred by the Genesis Flood. Not only does the paper exclude the possibility of long evolutionary ages, the findings of molecular discontinuity provide additional evidence against the classical concept of gradualistic genetic transitions promoted by evolutionists.

References

1. Stoeckle, S.M. and Thaler, D.S., Why should mitochondria define species? *Human Evolution* **33**(1–2):1–30, 2018. 10.14673/HE2018121037.
2. Jeanson, N., *Replacing Darwin: The new origin of species*, Master Books, Green Forest, AR, pp. 248–249, 2017.
3. Sanford, J.C., *Genetic Entropy and the Mystery of the Genome*, FMS Publications, Waterloo, NY, pp. 45–68, 2008.
4. Stoeckle, M.Y. and Thaler, D.S., DNA barcoding works in practice but not in (neutral) theory, *PLOS ONE* **9**:7e100755, 2014.
5. Cann, R.L., Stoneking, M., and Wilson, A.C., Mitochondrial DNA and human evolution, *Nature* **325**(6099):31–36, 1987.
6. Stringer, C., The origin and evolution of *Homo sapiens*, *Philosophical Transactions of the Royal Society B: Biological Sciences* **371**(1698):20150237, 2016.
7. Jeanson, ref. 2, pp. 182–186, 2017.
8. For a recent summary of molecular genetic evidence towards a young creation see: Tomkins, J., Empirical genetic clocks give biblical timelines, *J. Creation* **29**(2):3–5, 2015.
9. Tomkins, J. and Bergman, J., Evolutionary molecular genetic clocks—a perpetual exercise in futility and failure, *J. Creation* **29**:26–35, 2015.
10. Avise, J.C. Neigel, J.E., and Arnold, J., Demographic influences on mitochondrial DNA lineage survivorship in animal populations, *J. Molecular Evolution* **20**:99–105, 1984.
11. Sloan, P.R., The Buffon–Linnaeus controversy, *Isis* **67**(3):356–375, 1976.
12. Van Valen, L., A new evolutionary law, *Evolutionary Theory* **1**(1):1–30, 1973.

Humans produced fire more than one million years ago?

Michael J. Oard

The ability to control fire is considered an important human trait. So, the first known use of fire as a tool is thought to be a crucial turning point for the evolution of man.

Use of fire pushed back to greater than one million years in Africa

The unequivocal use of fire has been pushed back to allegedly about one million years in Wonderwerk Cave, South Africa.[1] This is the earliest 'securely' dated evidence for the use of fire in an archaeological context. This pushes back the habitual use of fire from supposedly 400 ka in Israel and suggests that not only were 'early' *Homo* able to use fire, but so also were Neandertals. After all, according to the evolutionary scenario, only Neandertals lived in Israel and Europe at that time.

Some scientists have suggested that man may have used fire even earlier. Their evidence came from speculative and indirect indications of body mass, feeding time, molar size, etc. From these they concluded *Homo erectus* may have used fire 1.9 Ma ago, since he was the type of early man that supposedly lived at that time. There are legitimate indications fire was used in that timeframe, but they could have been caused by wildfires.

The assumed sequence of human evolution indicates the use of fire began in the 'Acheulean strata' about 1 Ma, which is characteristic of

H. erectus. This suggests *H. erectus* also used fire.

Use of fire now found in Europe 800,000 years ago

It is now claimed that man in Europe could use fire 800 ka ago, much earlier than previously believed.[2] This is in the 'early Paleolithic' when mankind was assumed to be very primitive. The evidence consists of 165 stones and stone artefacts, and several hundred animal-bone fragments found in a Spanish cave that display signs of heating to 400–600°C, consistent with fire. Since the evidence was found about 8 m within a cave, the researchers considered it unlikely that the signs of controlled fire were caused by sparks from a wildfire.

Dating problems

Dating archaeological remains is always problematic. The cave sediments in Europe were dated to about 0.8 Ma because they had reversed magnetic polarity, which means that the sediments are older than the Bruhnes/Matuyama polarity reversal, dated at 0.78 Ma (figure 1). However, optically stimulated luminescence (OSL) dating gave an age of 0.3–0.5 Ma, while the cosmogenic isotope ratio $^{26}Al/^{10}Be$ gave a date near the Pliocene/Pleistocene transition about 2.6 Ma.

The OSL method depends on electrons trapped within the crystal structure of particular minerals, mostly quartz and feldspar, because of the background radiation from radioactive elements. Exposure to sunlight constantly resets the surface to zero. However, the 'electron traps' start building up upon burial. When the sample is stimulated with light, luminescence is given off; the amount is believed to be proportional to the age of burial.

Cosmogenic isotope dating depends upon the surface production of radioactive minerals by cosmic rays that penetrate a little more than a metre deep. Upon burial, build-up of radioactive elements ceases, and decay begins, which can produce a date for when the surface was buried. These are just two of the many methods for dating the Quaternary.

Some researchers doubt the date of 0.8 Ma for the Spanish cave sediments because the Bruhnes normal chron (<0.78 Ma) has short reversals within it called polarity excursions (figure 1). Excursions are defined as brief periods of $<10^4$ years during which the geocentric axial dipole shifts beyond the range of the secular variation. Sometimes this is a complete reversal, which changes back within 10^4 years. Therefore, it is difficult to use the reversals for dating.[3] In fact, it is now claimed that there have been 27 excursions and 10 polarity reversals just during the Quaternary.[4] It is claimed by other scientists that the tools in the cave indicate a date of no more than 0.6 Ma. But the researchers claim that their date of 0.8 Ma is supported by biostratigraphy (dating by fossils of extinct animals).

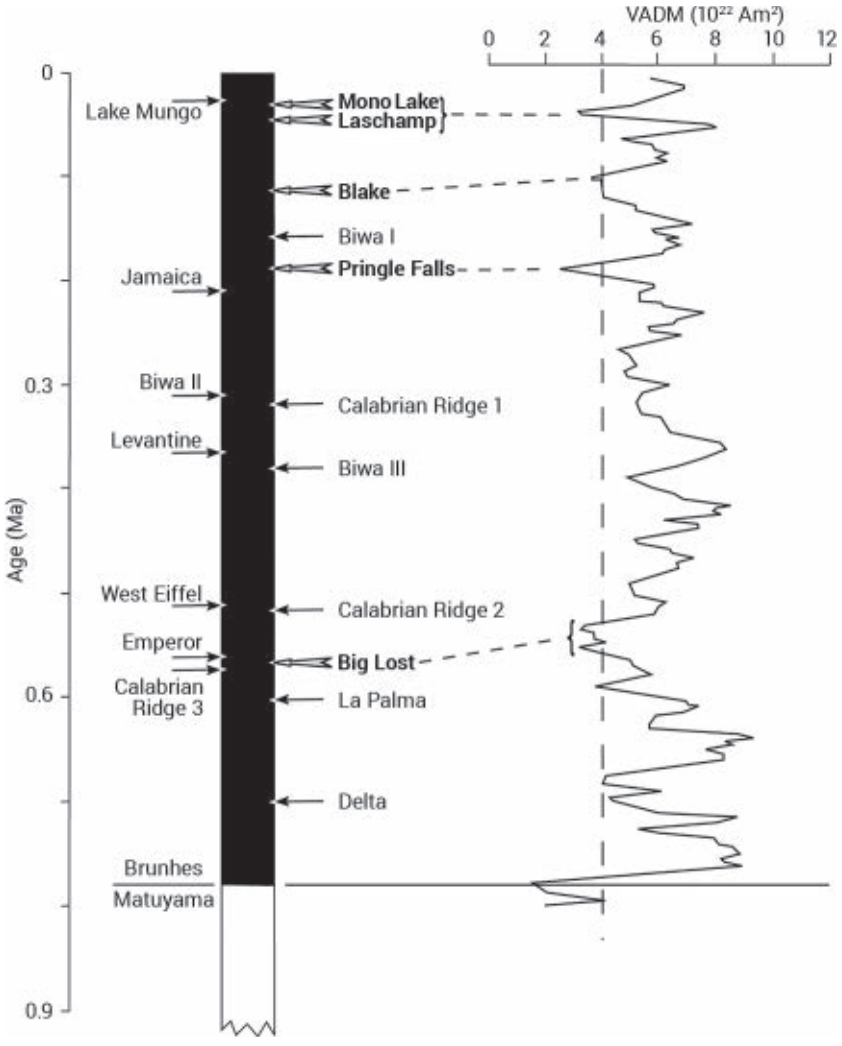


Figure 1. Geomagnetic timescale from the late Matuyama reversed chron through the Bruhnes/Matuyama transition showing the many polarity excursions (short reversals) now claimed for the Bruhnes normal chron

Creationist implications

The discovery that fire was used so 'early' in 'human history' indicates

that humans could always use their environment to their advantage. They were not primitive. Moreover, the 'earlier' dates reinforce previous evidence that *H. erectus* was a type of human, like Neandertals.[5]

The conflicting dates given for the Spanish cave reveal the subjectivity of Quaternary dating methods. For instance, paleomagnetism has so many excursions, major reversals called chrons, and minor reversals called subchrons, that one can easily date a particular polarity to *any* time within the polarity timescale. Moreover, vertical sequences of paleomagnetism are claimed to match certain sections of the standard polarity timescale (figure 1). But, if one adds increasing sedimentation or unconformities, any vertical series of paleomagnetic measurements can be made to match any polarity pattern. That is why paleomagnetism is *not* an independent dating method, although it has sometimes been touted as such. It depends upon other dating methods to 'anchor' it to deep time:

> "Magnetic polarity zones, however, are not in themselves uniquely diagnostic, and without the aid of additional stratigraphic indicators, correlation of magnetic zones in terrestrial sequences is problematic. For example, differences in depositional rates, and/or diagenetic histories between two areas, or the presence of subtle unconformities, can result in an unrecognizable mismatch of polarity zones."[6]

The converse is also true in that diagenesis,[7] changing deposition, and subtle unconformities can be invoked to make a vertical sequence match the desired polarity timescale, an example of circular reasoning. In the examples from the cave, the different dating methods did not line up, such as the OSL and $^{26}Al/^{10}Be$ dating technique. And even biostratigraphy conflicted with other evidence when it dated the age of the stone tools.

References

1. Bern, F., Goldberg, P., Horwitz, L.K. *et al.*, Microstratigraphic evidence of in situ fire in the Acheulean strata of Wonderwerk Cave, Northern Cape Province, South Africa, *Proceedings of the National Academy of Science* **109**(2):E1215–E1220, 2012.
2. Walker, M.J. *et al.*, Combustion at the late Early Pleistocene site of Cueva Negra del Estrecho del Río Quípar (Murcia, Spain), *Antiquity* **90**:571–589, 2016.
3. Bower, B., Europeans lit fires 800,000 years ago, *Science News* **190**(1):10, 2016.
4. Singer, B.S., A Quaternary geomagnetic instability time scale, *Quaternary Geochronology* **21**:29–52, 2014.
5. Lubenow, M.L., *Bones of Contention: A creationist assessment of human fossils*, Baker Book House, Grand Rapids, MI, 1992.
6. Larson, E.E. and Evanoff, E., Tephrostratigraphy and source of the tuffs of the White River sequence; in: Terry, Jr, D.O., LaGarry, H.E., and Hunt, Jr, R.M. (Eds.), *Depositional Environments, Lithostratigraphy, and Biostratigraphy of the White River and Arikaree Groups (Late Eocene and Early Miocene, North America)*, GSA Special Paper 325, Geological Society of America, Boulder, CO, pp. 11–12, 1998.
7. I.e. the physical and chemical changes that occur as sediment is converted to sedimentary rock.

Neandertals produced cave art

Michael J. Oard

New discoveries continue to confirm that Neandertals were fully human. For instance, it is common knowledge that the brain volume of Neandertals was larger than that of modern man. Recently, a more accurate measure was made, based on a larger sample, which takes into account the ontogenic age of the fossil. The study concludes Neandertal brains were about 3% larger than that of modern man.[1]

Regardless, some paleoanthropologists resist thinking Neandertals were anything other than brute cave men (figure 1). They describe them as primitive, having evolved from *H. erectus,* or some other 'archaic' type within the genus *Homo*. They dispute some of their uniquely human attributes, such as the ability to draw sophisticated cave art, thought to be an attribute of only modern man, *Homo sapiens.* Art is considered the ultimate 'symbolic behaviour', therefore unique to modern man. Claims of Neandertal authorship of cave art have been questioned by these same paleoanthropologists.

Even some Christians, such as Fazale Rana and Hugh Ross of Reasons to Believe (RTB) ministry, claim that Neandertals were soulless, primitive subhumans:

> "When all archaeological evidence is critically considered, it appears as though Neanderthals possessed some capacity for emotional expression and a level of intelligence, similar to that of the great apes today. Yet they clearly lived in nonhuman ways. To say that Neanderthals behaved like spiritual beings made in God's

image stretches the evidence beyond reasonable limits. The archeological evidence more closely coincides with the RTB model's perspective on these creatures—they behaved more like animals than like humans."[2]

Rock art from Spanish caves dated 20,000 years before modern man entered Europe

Uniformitarians believe Neandertals (or the precursor 'archaic' population they supposedly evolved from) entered Europe hundreds of thousands of years ago and modern man, e.g. *Cro-Magnon Man*, entered much later, around 45–40 thousand years (ka) ago. Practically all dates for cave art were previously considered to be less than 40 ka and attributed to modern man. A few claims of cave art dated much older than 40 ka were hotly disputed. Rock art is notoriously difficult to date, and so it is easy to dismiss 'unorthodox' claims.

Photo: M0001106, Wellcome Images / CC BY 4.0)

Figure 1. Diorama of Neandertal Man in an American museum during the 1930s reflecting the misconception reinforced by Marcellin Boule's description of them as dull-witted, brutish, ape-like creatures.

Recently, cave art from three Spanish caves has been dated by a new technique with surprising and seemingly more solid results. The new technique used the uranium-thorium (U-Th) dating method on carbonate precipitates that have coated or lie next to the cave art. Layers of calcite must be gently peeled away to avoid damaging the art work. Fifty-three dates were obtained.

The new method of dating the rock art produced dates of about 64.8 ka, at least 20,000 years before modern man arrived on the scene.[3] Since Neandertals were the only member of the genus *Homo* around at the time, the dates are automatically attributed to Neandertals. This would make Neandertals the mental equal of modern man: "These discoveries paint bulky, jut-jawed Neandertals as the mental equals of ancient humans."[4] In fact it is even possible that Neandertals *taught* modern man to draw.[5]

The new results open up the possibility that previously rejected results and dates may be 'accurate' according to the uniformitarian dating system. For creation science, these dates could give a relative sequence, not actual dates. Some of the questionable old dates that may be valid include a date of 176.5 ka for cave art in a French cave.[4] It also suggests that the symbolic use of marine shells and mineral pigments by Neandertals dated greater than 115 ka is also valid.[4] The authors believe they have *settled* the dispute over whether Neandertals produced cave art:

> "By showing that the Châtelperronian is but a late manifestation of long-term indigenous tradition of Neandertal symbolic activity, our results bring closure to this debate."[5]

A bombshell in paleoanthropology

These new results are a surprise to paleoanthropologists:

> "But few researchers imagined them [Neandertals] engaging in one of the most haunting practices in human prehistory: creating paintings—vehicles for symbolic expression—in the darkness of caves."[6]

A few still resist the new results. They challenge the U-Th method, claiming that small rock particles within the calcite can throw off the age estimates,[5] and there are numerous other problems with uranium-series methods.[7] Although admitting that there are many factors that undermine the 'reliability' of U-series dating on carbonate crusts, the lead author of the cave art study and others claim their technique is accurate.[8]

The authors of the new cave art dates state that they statistically corrected for contamination, and that the dates consistently increased down the layers from the surface of the carbonate crust. Moreover, the dates agreed with supposed geological evidence for low sea levels, low enough for Neandertals to enter the cave chamber.

Creation science implications

The new dates on cave art go a long way toward proving what creation science has been saying for a long time: Neandertals were just another type of people group that spread from the Tower of Babel area,[9] and that Reasons to Believe ministry is wrong about Neandertals, as they are wrong about many other aspects of biblical earth history.[10] Neandertals lived during the Ice Age just south of the ice sheets in Europe. To survive this harsh environment, they had to be an intelligent, robust people group.

The new results refute the idea that Neandertals were a cognitive 'intermediate' between an ape-like creature and man or a soulless

subhuman. Rather, they were fully human, reflecting the large cognitive gap between apes and people, consistent with the Bible.[11]

References

1. DeSilva, J.M., Comments on "The growth pattern of Neandertals, reconstructed from a juvenile skeleton from El Sidrón (Spain)", *Science* **359**(eaars3611):1–3, 2018.
2. Rana, F. and Ross, H., *Who was Adam?* NavPress, Colorado Springs, CO, pp. 195–196, 2005.
3. Hoffmann, D.L. *et al*., U-Th dating of carbonate crusts reveals Neandertal origin of Iberian cave art, *Science* **359**:912–915, 2018.
4. Bower, B., Rock art reveals Neandertals smarts: Hominid's cave paintings imply capacity for symbolic thinking, *Science News* **193**(5):6, 2018.
5. Hoffmann *et al.*, ref. 3, p. 915.
6. Appenzeller, T., Europe's first artists were Neandertals: Spanish cave paints date to before modern humans arrived in region, *Science* **359**:852, 2018.
7. Pettitt, P. and Pike, A., Dating European palaeolithic cave art: progress, prospects, problems, *J. Archaeological Method and Theory* **14**(1):27–40, 2007.
8. Hoffmann, D.L., Pike, A.W.G., García-Diez, M. *et al.*, Methods for U-series dating of $CaCO_3$ crusts associated with Palaeolithic cave art and application to Iberian sites, *Quaternary Geochronology* **36**:104–119, 2016.
9. Oard, M.J. and Oard, B., *Life in the Great Ice Age*, Master Books, Green Forest, AR, 1993.
10. Line, P., Progressive creationist anthropology: many reasons NOT to believe. A review of *Who was Adam?* by Fazale Rana with Hugh Ross, *J. Creation* **20**(3):31–38, 2006.
11. Rupe, C. and Sanford, J., *Contested Bones*, FMS Foundation, Geneva, NY, 2017.

A bombshell for American archaeology

Michael J. Oard

The understanding of the date humans entered the Americas from northeast Siberia is undergoing a change. It had been assumed the Clovis people, who are identified by their unique spear points, were the first Americans. Curry states, "For most of the past 50 years, archaeologists thought they knew how humans arrived in the New World."[1] The 'Clovis first' theory proposed that big-game hunters living in eastern Siberia followed Ice Age animals across the Bering Land Bridge and into Alaska about 11,000 years ago. By then the ice sheets had melted enough for an ice-free corridor to open up along the eastern slopes of Alberta and north-central Montana. The Clovis people and their offspring supposedly spread south from there into the rest of North America, Central America, and South America. This theory was upended when the Monte Verde archaeological site in Chile revealed an accumulation of bones and tools dated at about 14,700 years old.[2] So, the 'Clovis first' model has now been rejected, and a new date of about 15,000 years has become the 'new consensus'. But this has caused a problem, since the ice-free corridor from the Yukon Territory of Canada to Montana, US, was supposedly closed by the confluence of the Laurentide and Cordilleran Ice Sheets.[3]

Man in North America 130,000 years ago?

Claims for sites older than 15,000 years have frequently been made for the Americas (see below), but these have always been rejected. However, a new report with more substantial evidence has rocked American archaeology. The 27 April 2017 edition of *Nature* declared that man was in North America 130 ka (thousand years ago), during the last interglacial.[4,5] That is an order of magnitude increase in time! Their evidence comes from an undisturbed 12-m-thick 'fluvial' sequence along the coast of San Diego County, California, called the Cerutti Mastodon site (figure 1).

Knowing that such a massive departure from the consensus would require good grounds to be convincing, the many researchers involved used a meticulous protocol. They listed four criteria for acceptance, all of which they believed they fulfilled. The signs of man's handiwork are evidenced in the spatial arrangement of mastodon bones associated with cobbles in a fine-grained layer 20 to 30 cm thick. The cobbles were assumed to be tools. Battering marks on the bones are in a unique spatial arrangement, with the ends of some bones broken off, presumably to obtain bone marrow; and one mastodon tusk was vertical in the sediments with the distal end down. The bone breaks were made on fresh bone; wolf and horse bones in adjacent layers did not show the unique features found on the mastodon bones. This evidence for man compares well with other Paleolithic sites around the world. To go the extra mile, the researchers were able to duplicate the bone breakage pattern using stone cobbles for percussion on large elephant bones.

The date is the most shocking aspect of this find. They attempted C-14 dating but there was not enough collagen. They also tried to apply a relatively new dating method, optically stimulated luminescence (OSL), but it came out with a date greater than 60–70 ka. Finally, the uranium-series method was applied, which indicated a burial age of 130.7 ka. The researchers believe the date is accurate. This date greatly upends the accepted chronology of when man entered

Figure 1. Location of the Cerutti Mastodon archaeological site from extreme southwest California, US

North America. Mankind supposedly migrated to northeast Asia only about 30–40 ka.[6]

A few European archaeologists, who have worked in South America, have looked at the thorough report of Holen and colleagues and accepted the evidence at face value.[7] They try to appeal for an open-minded attitude among archaeologists, and believe that a thorough analysis of the Cerutti Mastodon Site and other controversial sites is needed.

What type of man?

The early date brings up the question of what kind of 'man' was in California during the last 'interglacial', since modern man supposedly had not yet colonized Asia. Modern man supposedly had not yet left Africa, according to the 'Out of Africa' theory. The human candidates include Neandertal Man, the elusive 'Denisovans' (based just on DNA[8]), or even a late population of *Homo erectus*. These 'archaic' people may have used boats and ocean currents to migrate down the coast from Alaska to Washington state, which would have suggested much greater intelligence than scientists have, until now, ascribed to them.

It is also debated whether the first people entered the United States by the coastal or inland route, although many claim the Pacific Coast route along southern Alaska, western British Columbia, and into Washington state has very little evidence.[9] This migration would have taken place at the peak of the last interglacial. It could have been from anywhere up north, since there were no ice sheets to block their way. But conversely, there would also have been no Bering Land Bridge. So, these people would have to have used boats for at least part of their journey, again implying that they were not as dumb as evolutionary theory would suppose.

Other reports

The gap between 15 and 130 ka is obviously very large, so the authors were obliged to mention other sites that may have existed during that timeframe. They list the Calico Hills, California site (originally thought to be 50–80 ka); the Pedra Furada site in Brazil (20–40 ka); and Old Crow, Yukon Territory of Canada. The 130 ka date may reopen the claim that Paleolithic Man left stone tools in western Alberta.[10,11] It also may validate the Taber child discovery found below Ice Age deposits in southern Alberta, claimed to be about 35 ka.[12] These sites are of course highly disputed by American archaeologists, it seems mainly because they are dated older than the 'consensus'.

American archeologists attack

Most American archeologists were stunned by this new report printed in the prestigious journal *Nature*. They have strongly challenged the new results. Gary Haynes claims that earth-moving equipment could have broken the mastodon bones.[13] The U-series date is also challenged, with Haynes claiming that there is no local source of uranium for uptake in the bones, and that the date did not agree with the OSL dates, although these dates were said to be a minimum. He further claims that there is no trace of the humans' trip to California for 115,000 years. Haynes also states that there have been many claims of extremely old humans in the Americas that have not panned out. He even claims that the broken stones are not tools, but were possibly crushed against other stones and bones by sediment compression. Haynes summarizes by suggesting that maybe other assumed human impacts on animal bones are natural:

> "On the other hand, if the claims are *not* true, it indicates that archeologists have clearly not been trained to be more aware of how noncultural processes affect fossil bones. Either way, we might have a lot to learn [emphasis in original]."[14]

Braje and other prominent archeologists actually accepted the uranium series date of 130 ka, but claim Holen and colleagues did not offer any alternative hypotheses, such as that the claimed artifacts are 'geofacts' and not of cultural origin.[15] They state the spiral fractures on the bones could be due to trampling. They also bring up all the debunked previous claims of ancient Americans, as if this somehow nullifies the new study. Braje *et al*. unwittingly

admit how a consensus can powerfully affect further research:

> "It has taken archaeologists decades of careful survey, excavation, analysis, and critical debate to break the Clovis barrier and extend the chronology of New World colonization back a few millennia."[16]

It is possible the reinforcement syndrome (where earlier results are reinforced by new discoveries), demonstrated in the 'Clovis first' theory, is also at work here. It may be hindering open analysis and debate about the Cerutti Mastodon Site.

The original researchers answer the challenges

The original researchers ably defend their 130 ka date claim for the oldest American by demonstrating that this unique bone breakage is *not* due to heavy equipment.[17] They also state that there has been a psychological bias against finding older Americans, first against the pre-Clovis people and now against this new research. This may reveal why they are unable to trace the path of the people to California. They admit that although there had been uranium series dating problems before, their analysis is claimed solid. They end by stating that Haynes is essentially offering his biased opinion:

> "Heavy equipment did not damage bones or stones except for a few during the initial discovery. Haynes (2017) offers no substantive evidence that sediment loading or heavy equipment broke proboscidean bone at the CM [Cerutti Mastodon] site, only his unsupported opinion. The totality of evidence from the CM site supports our claim that hominins broke the mastodon limb bones with hammerstones and anvils 130,000 years ago."[18]

In response to Braje *et al*., Holen and colleagues claim that the critics did not do a thorough analysis of the published evidence. Holen *et al.* insist the researchers were especially careful in handling and interpreting evidence at the site.[19] The stones could not have rolled to the site. To the charge that they did not examine alternatives, Holen *et al.* state that they did analyze carefully the possibility the bones could have been gnawed by carnivores or trampled by large mammals and discounted these possibilities. Moreover, Holen *et al.* charge that these critics did not offer any testable hypothesis that the stones are geofacts and not artifacts, and that the bone breakage was natural.

Creation science implications

Creation scientists can draw several implications from this bombshell. First, established concepts, such as 'Clovis first' or even the new consensus of 'pre-Clovis First' can be overturned with new data.

Second, skeptical attacks on consensus may show weaknesses in previous archeological evidence and indicate that some archeological claims may not be as solid as claimed. It also seems that earlier uranium series dating may be in error, although they were considered solid at the time or they would not have been published.

Third, it shows just how quickly secular ideas can change by adding a new variable, reanalyzing old data, new 'dates', or finding a new site in archaeology.

Fourth, if the results hold up, the previous two 'consensus' beliefs of 'Clovis first' and now 'pre-Clovis first' would show up to be arbitrary and affected by the reinforcement syndrome. Unfortunately, the reinforcement syndrome sometimes results in censorship of results that are contrary to the consensus. So, it is possible that all or some of those previously rejected 'old' archeological sites actually do show evidence of human activity.

In conclusion, we should be careful using uniformitarian dates and events as part of a relative biblical history model due to their unreliability.

References

1. Curry, A., Coming to America, *Nature* **485**:30–32, 2012.
2. Wade, L., Relics of the first Americans? *Science* **356**:13–14, 2017.
3. Stuart, A.J., Late Quaternary megafaunal extinctions on the continents: a short review, *Geological J.* **50**:338–363, 2015.
4. Holen, S.R., Deméré, T.A., Fisher, D.C. *et al.*, a 130,000-year-old archaeological site in southern California, *Nature* **544**:479–483, 2017.
5. Hovers, E., Unexpected early signs of Americans, *Nature* **544**:420, 2017.
6. Hoffecker, J.F., Elias, S.A., O'Rourke, D.H. *et al.*, Beringia and the global dispersal of modern humans, *Evolutionary Anthropology* **25**:64–78, 2016.
7. Boëda, E., Griggo, C., and Lahaye, C., The Cerutti Mastodon Site: Archaeological or paleontological? *PaleoAmerica* **3**(3):193–195, 2017.
8. Slon, V. *et al.*, Neandertal and Denisovan DNA from Pleistocene sediments, *Science* **356**:605–608, 2017.
9. Madsen, D.B., A framework for the initial occupation of the Americas, *PaleoAmerica* **1**:217–250, 2015.
10. Oard, M.J., Did 'old world early Paleolithic' people travel to North America? *J. Creation* **14**(3):3–5, 2000.
11. Oard, M.J., Controversy over 'Early Paleolithic stone tools' in Canada continues, *J. Creation* **15**(3):4–5, 2001.
12. Stalker, A.M., Geology and age of the early man site at Tabere, Alberta, *American Antiquity* **34**(4):425–428, 1969.
13. Haynes, G., The Cerutti Mastodon, *PaleoAmerica* **3**(3):196–199, 2017.
14. Haynes, ref. 13, p. 198.
15. Braje, T.D., Dillehay, T.D., Erlandson, J.M. *et al.*, Were hominins in California ~ 130,000 years ago? *PaleoAmerica* **3**(3):200–202, 2017.
16. Braje *et al.*, ref. 15, p. 201.
17. Holen, S.R., Deméré, T.A., Fisher, D.C. *et al.*, Broken bones and hammerstones at the Cerutti mastodon Site: A reply to Haynes, *PaleoAmerica* **4**(1):8–11, 2018.
18. Holen *et al.*, ref. 17, p. 10.
19. Holen, S.R., Deméré, T.A., Fisher, D.C. *et al.*, Disparate perspectives on evidence from the Cerutti Mastodon Site: A reply to Braje *et al.*, *PaleoAmerica* **4**(1):12–15, 2018.

Right about Genesis!

Right from the Start!
David M. Fouts
Self-published, 2015

Andrew Kulikovsky

David Fouts is a graduate of Dallas Theological Seminary and an expert in Hebrew and Old Testament exegesis, having studied under Bruce Waltke, Allen P. Ross, and Eugene Merrill. He has taught at Yellowstone Baptist College, Dallas Seminary, and Bryan College. In this self-published monograph, Fouts offers a detailed exegesis of the first two chapters of Genesis.

Fouts' motivation to write this book is partly due to the result of a survey that showed so few evangelical academics (44%) chose the simple accounts of Genesis 1–2 as authoritative over evolution regarding the origins of the heavens and the earth, and that 46% believed they could accept the theory of theistic evolution.

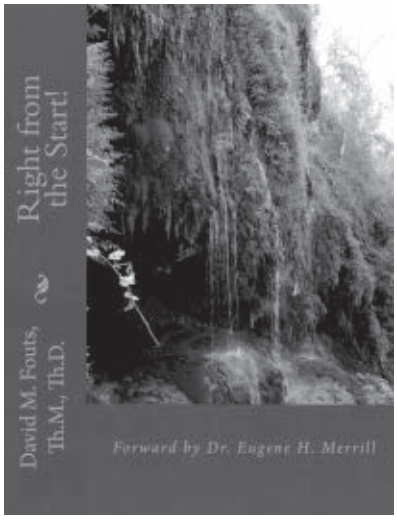
According to the author, many recent scholarly works by well-educated Hebrew experts and popular theologians all seem to 'waffle' when it comes to discussing the age of the earth. When recruiting employees for academic positions, or conscripting presidents and vice presidents, many college and seminary administrations have opted for either openly old earth creationists, or do not consider the issue of great importance in their curricula. In addition, many pastors, in an effort to be 'seeker friendly', have simply ignored teaching about the origins of the universe. It appears, the problem is not in understanding the text of Genesis, but in believing it. As Fouts argues, this alarming shift "is not because the text is not clear but rather that it is very clear" (pp. 15–16). Indeed, Fouts notes that few, if any, Christian colleges, universities, or seminaries now take an official stand on the issue of the age of the earth.

Authority of Scripture

Fouts poses the following key question: "Does the final authority rest in a perfect God, who revealed his truth in the words of the Bible, or in fallible man who fills in the details not revealed by the Bible?" (p. 20). While it is true that creationists also fill in many details that are not revealed in the Bible, we do not hold that our theories and models are equal to biblical revelation, nor do we propose theories and models that clearly contradict what *is* revealed in the Bible.

According to Fouts, evangelicals are faced with a choice to either accept the entire Bible as our authority from God, or none of it. Either we allow what most scientists claim are "assured scientific conclusions" based on empirical observations to be our authority, or we "return to the pages of Scripture for the authority granted to us by our God to proclaim truth in our increasingly secular society" (p. 22). Unfortunately, many have opted for fallible human understanding in preference to scriptural revelation. Indeed, there is little substantial discussion about the authority of the Bible as God's Word to mankind when considering the origins and age of the universe.

To demonstrate his point, Fouts cites Romans 1:20 ("For since the creation of the world God's invisible qualities—his eternal power and divine nature—have been clearly seen, being understood from what has been made, so that men are without excuse.") and then asks if we would interpret the creation in this way if it was not for these words from the Apostle Paul?



Fouts suggests it is doubtful, and if it wasn't for God's special revelation in Scripture, most people would end up believing in nothing more than the Greek or Roman pantheon of man-made gods.

Consistency in hermeneutics

Consistency in hermeneutics is rightly a key issue. Fouts asks:

> "If the Bible is in error in Genesis 1–2 (or is simply etiological, allegorical, literary instead of literal, or purely metaphorical), wherein it does clearly state the method of creation (by the divine fiat of God) and the length of time it took (six twenty-four hour days), then why in the world should I believe that the Bible contains any truth at all" (pp. 31–32)?

He then calls for evangelicals to return to a consistent faith position about the infallibility, inerrancy, and the authority of God's Word where it speaks not only to the issues of faith and practice but also to the issues of history and science. Christians must refuse to continue to bow down to the truth claims of fallible scientists who deny the universe's divine origin or deny the plain reading of the biblical account.

Fouts argues that those who avoid the issues of origins or purposely

move away from them do the Church a great disservice because they allow science to dictate our hermeneutical methods with respect to Genesis 1–2. He rightly questions whether the same approach will eventually be applied to the virginal conception, vicarious substitutionary atonement, or the resurrection since they are also scientifically impossible. Indeed, he points out that evangelical scholars rarely turn to the secular scientific community on any other matter apart from the interpretation of the creation account.

The conclusions of science or the opinions of scientific experts are not part of the standard historical-grammatical method of interpretation. Indeed, none of the standard texts on hermeneutics that discuss the process of historical grammatical exegesis include adjusting one's interpretation of the text in accordance with the current scientific consensus.

Fouts adds:

> "Never in the history of the church of which I am aware, have so many allowed data from the scientific world to influence their thinking to the point that they are willing to undermine the clearly stated words of Scripture in an effort to be scholarly acceptable to their nonbelieving peers. This may ostensibly be done in an effort to achieve additional financial support in para-church ministries, greater academic recognition, or to build larger churches" (p. 33).

For Fouts, science should only ever be consulted, if at all, after the proper procedures of biblical exegesis have been completed and the firm grasp of the meaning and message of the text has been obtained.

Genre

The author notes that some have taken Genesis 1 to be a prophetic oracle, interpreting the verbal forms in Days 5–6 as future imperfects ("The waters will teem with fish") rather than jussives of command ("Let the waters teem with fish"). But he points out that the morphology of the Hebrew verbs in Days 1–4 do not allow this interpretation. The verb forms for Days 1–4 are uniquely jussives of command, so it follows that the verbs in Days 5–6 should be interpreted in the same way.

Moreover, whereas a jussive of request is issued from an inferior to a superior, a jussive of command is issued from a superior to an inferior. Thus, the jussives in Genesis 1 must be understood as jussives of command because the Bible consistently presents God as the supreme power and authority in the universe (cf. Mark 4:39 where Jesus calmed the wind and the waves. And note that when Jesus performed miracles, the results were instantaneous).

In addition, the passage does not fit into any of the understood prophetic subgenres including salvation oracles, damnation oracles, exhortations, covenant lawsuits, disputations, and apocalyptic literature. Each of these are identifiable by content, structure, vocabulary, and, at times, by the figures of speech employed. "The Genesis account of creation does not fit into any of these subcategories so it absolutely cannot be considered prophetic" (pp. 43–44).

Many other exegetes believe the Genesis account is a form of poetry due to its 'exalted style' and the presence of symmetry, style, and structure. But this supposed 'exalted style' could just as easily be the work of the narrator, who is also a skilled writer, under the inspiration of an infinite God, in order to express the beauty and wonder of creation. The book of Acts also contains patterns of symmetry, style, and structure but no one believes Acts is a poetic work. Nor does the creation account contain the parallelism that is a central characteristic of Hebrew poetry.

Fouts also points out that a secondary characteristic of biblical Hebrew poetry is metrical balance within its lines. Metrical balance relates to the number of syllables counted within each part of a line (called a colon). Two cola comprise a line of poetry, usually having a syllable count of 4:4; 4:5; 5:5; 5:6, or similar, and two lines then form a couplet. However, this type of metrical balance exists only in Genesis 1:27, rather than throughout the entire account (Gen 1:1–2:3) as would be expected if it was indeed a poetic text.

Note also that the presence of figures of speech alone is not determinative of genre. Various figures of speech are found in all three major genres of Scripture: narrative, prophecy, and poetry. Although they are more abundant in poetic literature, they are not uncommon in other historical narratives (e.g. Gen. 15:5; 22:17; 1 Kings 10:27; Deut. 11:10).

Fouts rightly points out that the creation account is clearly identifiable as historical narrative, containing typical narrative features such as sequence, disjuncture, repetition, deletion, description, and dialogue, as well as the typical repeated use of *waw*-consecutive imperfect (or *wayyiqtol*) verb forms. Thus, he concludes that simply declaring the account to be a different genre without any similar examples drawn from other Ancient Near Eastern literature is untenable and nothing more than special pleading.


בראשית
GENESIS.
CAPUT I.

Figure 1. Genesis chapter 1 in Hebrew

Exegetical observations

Because the first word of Genesis 1, *bᵉrēʾšîṯ* (figure 1), does not have morphology indicating the presence of a definite article, some exegetes treat it as being 'in construct' with the second word *bārāʾ*, which is actually a verb. Although this is unusual syntax, it is not impossible. The verb *bārāʾ* is then revocalised to be in the infinitive construct form, allowing a translation like "In the beginning of God's creating …" or "When God began to create …".

But this translation is highly dubious as Fouts explains. Firstly, *rēʾšîṯ* is a temporal noun and adverbial temporal expressions regularly occur in biblical Hebrew without a definite article, yet are still translated as if they were definite (or even absolute) nouns. Anarthrous (i.e. without the article) temporal nouns translated as definite can be found in Proverbs 8:23, Ecclesiastes 3:11, Isaiah 40:21, and Isaiah 41:4, 26. Indeed, most temporal nouns have anarthrous forms in the Hebrew Bible.

In addition, *bᵉrēʾšîṯ* has Hebrew disjunctive accentuation which indicates it stands as an independent phrase—not in construct but as an absolute. Indeed, no other ancient versions of the Bible understood *rēʾšîṯ* as being in construct with the following verb. Nor is there any textual support in any extant manuscript for the revocalising of *bārāʾ* as an infinitive construct.[1]

The author understands the use of "the heavens and the earth" in Genesis 1:1 as merism (or merismus), conveying the notion of the universe in its entirety. This is a common view but I think it is mistaken because the Israelites regarded the heavens and the earth as two separate entities and did not have a concept of a unified world until much later. Moreover, 'the earth' is specifically referred to as a separate entity in a circumstantial clause in the very next sentence. This singling out of the 'earth' distinguishes it from the supposed merism that is meant to refer to the universe as a whole.

Fouts understands the Genesis 1:1 as a 'topic sentence' (p. 65) for the account and Genesis 1:2 simply describes the state of things that existed when God began his creative work on Day 1. However, this would mean there is no explanation for the actual origin of the heavens and the earth since verse 2 merely describes their initial state. In addition, Genesis 1:1 cannot be a title because the connective conjunction *wᵉ* in verse 2 suggests a grammatical dependency, and taking verse 1 as a topic title also sets up a contradiction: how can it be said that God created the earth when in fact it already existed in some form?

Regarding gap theorists' claims that *hāyᵉtāh* in verse 2 should be interpreted as a pluperfect ("Now the earth had become"), Fouts points out that, although that interpretation is grammatically possible, the contextual markers are missing: "there must be a main verb in the past tense, in order to indicate that the action of the past perfect chronologically precedes the action of the main verb, i.e., some statement or event to which the past perfect provides a setting" (p. 68). But there is no such verb in this context.

Fouts responds to the claim that Hosea 6:2 is an exception to the rule that *yôm* with a number always indicates a normal 24-hour day. He points out that Hosea 6:2 is a clear instance of a poetic expression well known in Ancient Near Eastern literature and found elsewhere in the Old Testament (Job 40:5; Prov. 6:16; 30:15, 18, 21, 29; Amos 1:3, 6, 9, and many others). Of course, if, as many interpreters believe, Hosea 6:2 is a prophecy about the resurrection of Christ, then 24-hour days are still in view and Hosea 6:2 would not be an exception to the rule.

In any case, Fouts argues that given the presence of the conventional poetical X/X +1 device, the occurrence of *yôm* in Hosea 6:2 is most likely not relevant in the discussion of the meaning of day in Genesis 1 because Genesis 1 is narrative rather than poetry. Nor does the X/X +1 parallelism exist in Genesis 1 or anywhere else in biblical Hebrew narrative texts. It is found exclusively in poetic and prophetic texts.

Fouts also makes the interesting observation that the use of *yôm* in a construct relationship is a glaring omission within Genesis 1:1–2:3, because outside of Genesis 1 there are many examples of *yôm* in construct with other nouns which may indicate indefinite length of time.

Another interesting observation Fouts makes is that when 'evening' proceeds 'morning' outside of Genesis 1 (e.g. Exod. 27:21; Lev. 24:3), it refers to a nightly task such as keeping the lamps burning in the tabernacle. Thus, the ordering in Genesis 1 indicates a period of darkness following God's daytime creative activity.

Fouts notes that the Hebrew clause *wăyᵉhî ḵēn* ("and it was so") appears only twice outside of Genesis 1—Judges 6:38 and 2 Kings 15:12—and appears to indicate that something has been completed, i.e. God's creative commands were completed as soon as He spoke.

Regarding the numbering of the days in Genesis 1, Fouts notes that the ordinally numbered second through fifth days have no article, which suggests a rendering of "a second day", "a third day" etc. as the NASB renders it.

However, after an analysis of the use of ordinal numbers in Hebrew, Fouts argues that the presence of the ordinal number itself is sufficient to establish definiteness regardless of the presence or absence of an article on the noun 'day' or on the ordinal number that qualifies it. In other words, the rendering should be "the second day", "the third day" etc. The seventh day

alone has *yôm* with the article so Fouts suggests this indicates a difference in quality even though it says nothing about duration.

Fouts points out that the Hebrew word *ṣĕlĕm*—usually rendered as 'image' in most versions—is normally associated with idols in the Old Testament outside Genesis. He prefers the gloss 'representative' and argues that the choice of this word is interesting because idols represent dead gods who have no substance whereas human beings are designed to be representations of the Living God. However, being made in God's image implies that we are actually a *representation* of God rather than a representative of God.

In the description of God forming Adam from the dust (Gen. 2:7), the verb employed is *yāṣăr*, which, as Fouts points out, denotes both purpose and design. Indeed, Isaiah 44:2 and 49:5 both speak of God forming the fetus in the womb. The material God used to make man was the dust of the earth he had just created. As the Psalmist declares, God is mindful that we are merely dust (Ps. 103:14). Fouts points out that dust is never attributed with any value in Scripture and is often associated with death (Gen. 3:19; Ps. 22:15; Dan. 12:2). God formed His image bearers from the worthless, inanimate, and lifeless dust of the earth, and gave us life by breathing into the man's nostrils the breath of life. Only then did man become a living being (Gen. 2:7).

The author asserts that man is distinct and set apart from the rest of the animal kingdom because he has the *n*^{e}*šāmā* ("breath") of life, and this gives man understanding (Job 32:8) and enables his conscience (Prov. 20:27). Fouts asserts that it is never used of any living being other than humanity. However, this is not the case. The same term is used in Genesis 7:22 in reference to all living things including both men and animals.

Fouts is firm that Adam and Eve were actual historical individuals rather than mere mythical symbolic or allegorical figures, and notes that there is ample evidence in the Scriptures outside of Genesis where other writers referred to them as such (Rom. 5:12–21; 1 Cor. 15:22–45; 1 Tim. 2:13–14; Luke.3:34–38 and Jude 14).

The author understands the geographical context of the naming of the animals to be within the confines of the Garden of Eden and therefore suggests Adam may only have named those animals that were present in the garden: "Could it not be that Adam named only that fauna concomitant with the garden itself, i.e. a limited amount of animals in an apparently somewhat confined space, rather than all possible species that would eventually roam the entire globe?" (p. 138). As I have shown elsewhere, there is no need for such limitations, which ultimately sound like special pleading.[2]

On the framework hypothesis

Fouts notes the rising popularity—even among his friends and colleagues—of the so-called 'framework hypothesis' in recent years and his book contains an appendix specifically critiquing this view. There are many other critiques of this view now available, but Fouts believes advocates have subconsciously bowed to uniformitarian science in an attempt to be academically acceptable to the scientific community and to other biblical scholars who have been influenced by it.

One other important observation that I have not seen elsewhere is Fouts' contention that the literary framework hypothesis does not account for the sequencing of days established by the presence of the Hebrew ordinal numbers. The ordered sequence has no meaning and serves no purpose in a framework where the days do not correspond to any temporal reality. In fact, the presence of the ordered sequence is evidence *against* the literary framework.

Conclusion

Fouts rightly notes that bowing to science results in removing God from the creative process, as well as calling into question the historicity of Adam, Eve, the Fall—indeed, the virgin birth of Christ and His resurrection. If there is no Fall, then there is no sin nature, and thus no need for the virginal conception or resurrection. In fact, there is no need for Jesus at all! As Fouts points out, this is a deliberate strategy by Satan to undermine Christianity and the Gospel.

The focus of this book is fairly narrow so it does not cover many of the wider historical and theological issues relating to creation. Its main strength is in hermeneutical principles and the detailed exegesis of the Hebrew text. Fouts makes many significant exegetical observations, some of which I have outlined above. In any case, this work is well worth our attention, and the keen Bible student will learn much from it.

References

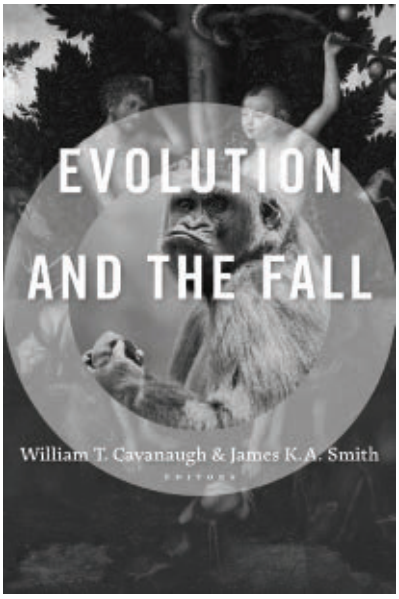
1. Also, it requires a long-winded beginning for Genesis, e.g. as modern JPS: 1 When God began to create heaven and earth—2 the earth being unformed and void, with darkness over the surface of the deep and a wind from God sweeping over the water—3 God said, "Let there be light"; and there was light. Even the skeptic Wellhausen said: "Aber diese Construktion [*sic*] ist verzweifelt geschmacklos …" (But this construction is desperately tasteless … *Geschichte Israels (History of Isra*el), vol. 1, 1878.
2. Kulikovsky, A.S., How could Adam have named all the animals in a single day? *Creation* **27**(3):27, June 2005.

Theistic evolutionists' views of the Fall fall short

Evolution and the Fall

William T. Cavanaugh and James Smith (Eds.)

Wm. B. Eerdmans Publishing Co., Grand Rapids, MI, 2017



Joel Tay

Evolution and the Fall is a collection of ten essays by a team of theistic evolutionists and funded by Biologos. The book starts out by acknowledging that the scientific consensus (i.e. evolution) is problematic for a plain reading of biblical creation. Evolution tells us that all humans emerged from a group of primates and not an original human pair (i.e. Adam and Eve (p. xv)). This is incompatible with the biblical teaching of a 'good' creation, an 'original righteousness', and a historical 'Fall' from innocence (pp. xvii–xviii). Since evolution teaches that mankind did not come from an ancestral pair, this undermines the traditional understanding of Original Sin.

This Scripture/evolution 'tension' is then portrayed as the modern-day equivalent of the 'hypostatic' controversy—the conundrum faced by the Council of Chalcedon (figure 1), where theologians struggled with two seemingly incompatible concepts (i.e. the divinity and humanity of Christ), resulting in what has now come to be known as the hypostatic union—the doctrine that Jesus is fully God and fully man.

Presenting this tension between evolution and biblical creation as a Chalcedon moment and not a church vs Galileo moment, when Galileo's heliocentricism rocked the church in his day (p. xvi), the authors declare that we need to marry evolution and the Bible equally. But this is disingenuous, because BioLogos has itself openly refused to affirm biblical inerrancy and even gone as far as to say that Jesus and Paul got it wrong when it comes to creation.[1]

Interestingly, the irony with this Chalcedonian analogy is missed by the authors: it was the Council of Chalcedon's refusal to deviate from the plain reading of Scripture that led to the formulation of the doctrine of hypostatic union. In contrast, *Evolution and the Fall* proposes moving away from a straightforward reading of biblical texts to conform the Bible to evolution.

After the introductory chapter, which acknowledges the challenges theistic evolutionists face when explaining Original Sin, the rest of the book pivots around the next chapter—numbered as chapter 1. Chapter 1 reads like a secular evolution textbook, summarizing the current evolutionary consensus on hominin origins. The chapter concludes by asserting that evolutionary science shows that modern humans were not descendants of an Adam and Eve pair, but rather evolved out of a group of at least 10,000 individuals in sub-Saharan Africa.

The authors did not seem to be aware of, or at least chose not to mention to their readers, creationist literature that shows that human genetics fits nicely with what we would expect if we were to start with biblical history and an Adam and Eve pair. For example, Robert Carter, as far back as 2011, demonstrated that the "data fit(s) nicely into the straightforward biblical model, including a single starting couple a mere 6,000 years ago".[2] More recent publications by Carter further drive home this point.[3]

This literary sleight of hand in chapter 1 is significant, because every subsequent chapter in this book simply assumes (wrongly) that genetics rejects a historical Adam and Eve. This wrong assumption consequently leads the authors to require abandoning the doctrine of Original Sin; claiming that Paul and Jesus got it wrong; allegorizing the creation account; or just modifying the traditional interpretation of the Bible—since it contradicts evolution.

A chapter-by-chapter analysis follows for clarification.

Chapter 1: By Darrel Falk (human anthropology and genetics)

There are three parts to this chapter. First, Falk goes through evolutionary anthropology and argues for an evolutionary progression leading to the emergence of *H. sapiens*, ~195 ka. E.g. *H. naledi* (figure 2) is presented in this chapter as an example of this progression (p. 6). Falk writes, "At this writing, the specimens (i.e. *H. naledi*) remained undated" (p. 6).

Granting that Falk could have written this chapter before 2017, this does not change the fact that the book was already outdated at the time of publication. The new

dates for *H. naledi* contradict Falk's evolutionary expectations. Peter Line explains that *H. naledi* was first thought to be at least 1.8 Ma, existing before the first occurrence of *H. erectus*, but a phylogenetic study in 2016 dated it at 912 ka. By May 2017, it was redated at 236 ka to 414 ka. And, finally, a radiocarbon date of 33.0 ka to 35.5 ka was also obtained, but this was rejected altogether as it did not fit the evolutionary timescale.[4] The currently accepted date for *H. naledi* is 236–335 ka.

The evolutionary 'science' had already moved on before Falk's chapter was even published—three times! Similarly, he dates *H. sapiens* as first appearing around 200 ka, although since the middle of 2017, the evolutionary paradigm has already redated the oldest *H. sapiens* found at 300 ka, in Jebel Irhoud, Morocco—making *H. sapiens* contemporaneous to *naledi, erectus,* and Neandertals. So this book is already outdated by evolutionary standards! Yet this ever-changing evidence is supposed to be the firm 'scientific consensus' that Falk insists demands the reinterpretation of Genesis. Furthermore, Christopher Rupe and John Sanford, in their newly published book *Contested Bones*, have now convincingly concluded that *H. naledi* is simply just a "degenerant human population that lived in isolation".[5]

The second part focuses on genetics. Falk claims that the number of mutations present in humans cannot be traced back to a human ancestral pair. This ignores Robert Carter's research from as far back as 2011, which demonstrates that, contrary to the claims of BioLogos, the genetic data actually fits well with biblical teaching that all humans descended from a human pair.[6] Once again, Falk is found guilty of using outdated science at best, or, at worst, being ignorant of the published works on the subject.

Falk ends his chapter arguing that natural selection alone requires too much 'luck' to account for the evolution of man; thus, it makes more sense to view human evolution as an act of divine providence. Here again, we see Falk's inconsistency, where he is willing to invoke a miracle for the evolution of man—to account for 'luck', but is not willing to invoke a miracle for biblical creation when the Scripture is clear.

Figure 1. Artist's impression of the Council of Chalcedon, AD 451

Chapter 2: Celia Deane-Drummond (theology)

The last century has seen the gradual acceptance of evolution by Roman Catholic Popes. Thus, the author concludes, theologians today do not have to be afraid of science even if it changes all the time. After all, theology is also constantly being revised with each passing generation. According to Deane-Drummond, Roman Catholicism teaches that death did not enter the world through sin. Instead, original sin simply means that man "ought to possess divine grace but does not do so" (p. 32).

Niche Construction Theory (NCT) is the idea that changes made by a creature to its environment affect selection pressure; and selection pressure in turn affects the creature's very own evolution and that of those that share its environmental niche. In this sense, creatures become co-directors of their own evolution (pp. 33–34). Reinterpreting the Fall within the context of NCT, she interprets the Fall as "a spreading of destructive behaviour", where those who fail to cooperate with others in community are labelled as sinners and punished accordingly. She rejects the "literal figures of Adam and Eve or a literal paradisiacal Eden before the Fall" (pp. 35–36).

She insists that the Apostle Paul is mistaken for thinking of Adam "as a single individual in whose sin all humanity in subsequent generation" participates (p. 46). Instead, the Fall is re-interpreted to represent the failure of the human race to achieve its potential: "... the ideal state should be viewed in community relationships, including multispecies relationship with other creatures, and that the Fall results in a distortion in those relationships" (p. 43). Original Sin, according to Deane-Drummond, is not required for the Christian faith (p. 44). Instead, original sin just means that we are born into an imperfect community where it is impossible not to be a sinner. Original

sin has nothing to do with inherited guilt (p. 45).

Chapter 3: James Smith (philosophy)

According to the Smith philosophy, the Fall offers "a theological account of human origins that doesn't jeopardize the goodness of God or human responsibility" (pp. 49–50). Since he believes that the goodness of creation preserves the doctrine of the goodness of God (p. 53), he reasons that goodness necessarily existed prior to evil, and that creation was *ex nihilo* (pp. 52–53). However, he sees the traditional teaching of human descent from an original human couple as clearly contradicting evolution. To reconcile Scripture with evolution, Smith suggests that it is possible to recognize that humanity descended from a larger pool of individuals and yet still affirm that God has created man in his image.

Smith goes on to suggest that the Fall is not a literal historical event where Adam and Eve 'fell' into sin because of a decision they made. Such an understanding would certainly contradict evolution. But it might be possible, he suggests, to reject the "punctiliar aspect of the traditional model" and yet retain a "temporal, historical" understanding of the Fall. That is, Smith is saying that we can reject that the Fall was a literal one-time event in one sense, and yet separately affirm its historicity within a theological framework as a kind of 'episode-in-process' (p. 63). This modification to the traditional interpretation is necessary "if we—for theological reasons—are going to take the science seriously" (p. 58).

As a reader, this comes across as eerily similar to the Barthian Neo-orthodox doctrine of the *Geschichte vs Historie* divide, where one can claim that an event happened in the theological sense, all the while denying it occurred as a real historical event. Notice how the Bible is always reinterpreted so as to fit evolution. Belief in evolution is never questioned.

Chapter 4: J. Richard Middleton (Old Testament)

H. sapiens are asserted to have evolved 200,000 years ago from a population of 2,000 to 10,000 individuals (p. 67). This contradicts the biblical account. Creationists, in particular, assume the "Bible intends to teach a true scientific account of cosmic origin—including a young earth and the discontinuity of species (particularly the discontinuity of humans from other primates)" (p. 668). Unfortunately, Richard Middleton promotes another straw man argument here when he wrongly claims that biblical creationists believe in the fixity of species—yet another example of the shoddy scholarship that pervades the entire book.

Middleton asserts that a straightforward reading of creation "clearly contradicts ... modern science" (p. 68). He claims that the doctrine of 'Original Sin' is not required for creedal orthodoxy even if, at a superficial level, the biblical origin of evil and the Fall seem to contradict evolutionary biology (p. 69). Rejecting Stephen Jay Gould's Non-overlapping Magisteria (NOMA), where theological truth and scientific truths belong in different conceptual domains and thus do not contradict one another (p. 69), Middleton thinks that science should shape our theology (p. 70). Thus, Middleton uses the evolutionary history of *H. sapiens* as the interpretive framework for the Fall (p. 72).

Figure 2. *H. naledi* skull recreated by digital reconstruction of fossil fragments from different individuals at the fossil site

Chapter 5: Joel Green (New Testament)

Green wrongly asserts that the traditional view, where we are accountable for the actions of Adam, is a "historical and moral non-starter" (p. 99). Furthermore, he wrongly claims that biology tells us that it is absurd to believe in a single original couple that divided history into a pre-Fall and post-Fall era. Since Original Sin is never mentioned in the ecumenical creeds, Green asserts that an acceptance of this doctrine is not a requirement for orthodoxy (p. 99). He ignores that creeds were responses to particular heresies, e.g. the Nicene Creed refuted the Arian heresy.

Green asserts that the whole church has never reached a consensus on Original Sin. Here, he fails to inform his readers that the Western church certainly followed Augustine (figure 3) and rejected Pelagius, and while not ecumenical in the sense of uniting the Eastern and Western church, the Council of Orange (529) clearly declared a rejection of Original Sin to be heresy. Continuing from this error, Green asserts that the Bible never teaches that sin is a physical inheritance. Physical inheritance of sin, according to Green, is a much later development by Christian theologians. Appealing to a liberal understanding of the early church and its tradition, he asserts that second temple literature never understands sin as an inherent human condition (pp. 114–115). Paul and James are said to have assumed sin's heritability and its corporate dimensions through Adam, but only in the sense of sin's influence and pattern. James' emphasis is that God is not the author of sin, while Paul's emphasis was the pattern set for all humanity by Adam (p. 116). However, neither Paul nor James teaches that sin is passed down through procreation.

Since evolutionary biology has undermined the idea that sin was imputed to all humanity through Adam and Eve, Green rejects the 'Fall' as a real historical event and concludes that the biblical account of the Fall does not require belief in original sin (p. 144–146).

Chapter 6: Aaron Riches (theology)

Aaron Riches tells us that the Catholic Church has always affirmed a historical Adam whose deed brought sin into this world. However, evolution teaches that the human race was derived form an ancestral population of around 10,000 individuals. Thus, the creation account has been relegated to a mere myth. We're told there was no original Adam, and thus actions purported to have been committed by him cannot be responsible for the negative experience of human history. To reconcile Genesis with evolution, we're told we must interpret Genesis as a poetic and powerful allegory (p. 120); instead of looking at Adam and interpreting Christ through Adam, we should look at Christ to understand Adam, Adam is the type; Christ is the archetype.

Riches's error should be obvious to any discerning Christian: Adam is never called the first Christ in Scripture. Instead, in 1 Corinthians 15, it is the other way around—Jesus Christ is called 'the last Adam', in contrast to the 'first man, Adam'. In an attempt to avoid the clear historical teaching of the Creation Week, Riches resorts to turning theology on its head.

Table 1. Explanation of how Middleton allegorizes the creation account as symbolic of man's struggle

Symbol	Meaning
Adam	Archetype of humankind. Earth Creatures, just like animals (p. 73–74)
Eden	Ancient Near East sacred grove where dirt is transformed into God's image (p. 74)
Image of God	At the end of hominid evolution, *H. sapiens* represents God in the world. (p. 75–76)
Garden	Manifestation of God's presence through God-glorifying culture (p. 76–77)
Tree of Life	Wisdom (Proverbs 3:18) and earthly flourishing (p. 79)
Life and death	Life conformed to God's wisdom (p. 79)
Genesis 3:15	Not Protoevangelium (p. 91), but a struggle with the snake, a symbol of human ethical choice (p. 86) and man's struggle with idolatry (p. 91).
Genesis 6	Increasing sinfulness: the communal and systematic evil we are born into (p. 96)
Violence before the Fall	Not a problem in the beginning since it is only sin after a creature evolves the ability to understand the word 'No!' (p. 83)

Chapter 7: Brent Waters (ethics)

The author posits that the creation account represents the impulse to overcome human limitations through our own effort. He gives the example of humans' attempt to overcome aging and death through the use of technology—something he calls 'transhumanism'. Prosthetic limbs, organs, and artificial blood vessels, he says, are examples of this war against our mortality. He considers transhumanism a heretical mutation of Christian eschatology. Instead, he encourages Christians to recognize their own fallenness and their need for forgiveness and to forgive.

Chapter 8: Norman Wirzba (theology and ecology)

Wirzba claims that original sin is the lack of awareness that God is all in all. The creation account is about the way things now are contrasted with the way they could be if the world were to participate fully in God's rule. Creation lays out the responsibilities

of humans. Christ is the lens that helps us interpret creation and whether the world is flourishing or fallen, and the Fall is an account of struggle. Creation is not teaching us the science of origins. Rather, it tells us about God and his reconciliation of all creatures to Himself. Taken this way, creation gives voice to the mission of the church, theosis, sin, and the meaning of life. Lastly, fallenness is interpreted as a description of a creature's inability or refusal to find its fulfillment in God and divine love.

Chapter 9: William Cavanaugh (politics)

Cavanaugh tells us that the rejection of 'the Fall' in Genesis has political rather than scientific roots. He gives an overview of important philosophers (especially Locke and Hobbes) and shows how their view shaped their politics. Historically, 'the Fall' served medieval politics by contrasting the difference between the world in its broken state and that of the biblical utopia. This emphasis on 'the Fall' waned away over time in early modern political theory and was replaced by a view that politics is a response to the fallenness in nature. Finally, he asserts that in the long run science will be increasingly divorced from theology and from the church, and it will be increasingly divorced from teleology, with 'the Fall' eventually being discarded as a quaint myth.

Chapter 10: Peter Harrison (history of science/religion)

Harrison is a noted historian on the history of religion and science.[7] He writes that young-earth creationism is associated with an undesirable religious fundamentalism, right wing politics, bigotry, and backwardness. Even mainstream Christian denominations, we're told, take a dim view of scientific creationism. But tension between Christianity and science is not always bad. Harrison lists BioLogos and several other institutions that have been foremost in promoting peaceful relations between science (i.e. evolution) and religion. The theory of evolution needs to be viewed apart from its specific mechanisms and implications.

In this chapter, Harrison attempts to lay out a proper 'Christian' approach so that, even in embracing evolution, we can say that in Christ "all things hold together". We are to read Scripture literally first, he says, but if there is a conflict about a proven truth of nature and an interpretation of Scripture, Scripture should be reinterpreted. If there is a conflict and the science cannot be proven, follow Scripture (actually, Augustine would have agreed that evolution falls far short of being proven science[8]). Lastly, he concludes that the words of Scripture were adapted to the capacities of its readers and that its primary concern is salvation, not science.

Bringing the book to a close, Harrison points out that it would be unrealistic to expect science and Christianity to always agree; and when they are incompatible, it does not necessarily mean that our theology must change. It could be that the science is wrong. He also concedes that evolution is wrong in its idea of common descent with modifications.

Conclusion

Since the authors in this book recognize that the doctrine of Original Sin is problematic for evolution, and yet decide to abandon not evolution but the traditional view of original sin, one can only conclude that these individuals have fallen into the Pelagian heresy.[9] *Evolution and the Fall* is poorly written, filled with poor scholarship, and falls outside the boundaries of Christian Orthodoxy. The entire book revolves around the premise that humans evolved from a group of 10,000 individuals in Sub-Saharan Africa. The authors acknowledge that this is problematic for the traditional understanding of Original Sin which requires all humans to be the offspring of Adam and Eve. Each essay in this book proceeds to either modify or reject Original Sin. *Evolution and the Fall* was funded by Biologos. This is significant because Dennis Venema, who recently stepped down as the Fellow of Biology at Biologos, published *Adam and the Genome*, prior to the release of *Evolution and the Fall*. *Adam and the Genome* provided the scientific basis for arguing that we could not have evolved from a human ancestral pair. *Evolution and the Fall* assumes this to be true and for this very reason, its authors modify or reject Original Sin. But Dennis Venema has now backtracked from his earlier assertion. Furthermore, at the recent ICC 2018, Dr John Sanford published a paper showing that contrary to what the authors of this book propose, the genetic diversity in human beings not only fits what we would expect if we came from a human couple, but it actually fits the biblical creation model better than the evolutionary model and 'old-earth' creation models.[10] Robert Carter followed up with another paper on Y-Chromosome Noah and mitochondrial Eve showing that we can not only trace our human genetic lineage back to Noah, but we can also trace the historical lineages of humans such that we can even identify the genetic lineage of the three sons of Noah that are now ancestral to all people groups today.[11] He now admits that genetics does not exclude the possibility that all humans descended from a human couple.[1,12] This undermines the central premise of *Evolution and Fall*. If all humans could have descended from an Adam and Eve couple, there is no need to reject or modify Original Sin. In other words, *Evolution and the Fall* serves no purpose. *Evolution and the Fall* is a classic example of what happens when we reject sound doctrine to fit the science, only to have the *science* change a year later.

References

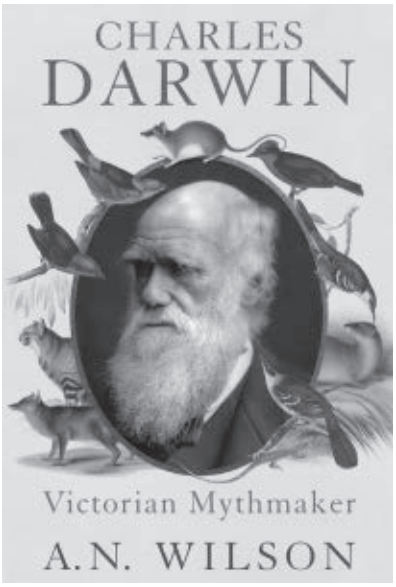
1. See documentation in Cosner, L., Evolutionary syncretism: a critique of *BioLogos*, creation.com/biologos, 7 September 2010.
2. Carter, R.W., The non-mythical Adam and Eve: Refuting errors by Francis Collins and *Biologos*, creation.com/biologos-adam, 20 August 2011.
3. Carter, R.W. and Powell, M., The genetics effects of the population bottleneck associated with the Genesis Flood, *J. Creation* **30**(2):102–111, 2016.
4. Line, P., Den of ape-men or chambers of the sickly: an update on *Homo naledi;* creation.com/naledi, 25 May 2017.
5. Rupe, C. and Sanford, J., *Contested Bones*, FMS Publications, p. 210, 2017.
6. Carter, R.W., The non-mythical Adam and Eve: Refuting errors by Francis Collins and *Biologos*, creation.com/biologos-adam, 20 August 2011.
7. Refer to our previous reviews of Weinbger's books:
   Weinberger, L., Reading the Bible and understanding nature: A review of *The Bible, Protestantism, and the Rise of Natural Science* by Peter Harrison, *J. Creation* **23**(3):21–25, 2009; creation.com/review-harrison-bible-protestantism-natural-science;
   Weinberger, L., The Fall and the inspiration of science: A review of *The Fall of Man and the Foundations of Science* by Peter Harrison, *J. Creation* **24**(3):18–21, 2010; creation.com/the-fall-inspiration-for-science.
8. Cosner, L. and Sarfati, J., Non-Christian philosopher clears up myths about Augustine and the term 'literal', *J. Creation* **27**(2):9–10, 2013; creation.com/augustine-myths.
9. Fangrad, R., *BioLogos*, theistic evolution and the Pelagian heresy: Debating an historical Adam and the destruction of the Gospel, creation.com/biologos-pelagian-heresy, 22 March 2014.
10. Sanford, J., Carter, R., Brewer, W., Baumgardner, J., Potter, B., and Potter, J., Adam and Eve, designed diversity, and allele frequencies; in: Whitmore, J.H. (Ed.), *Proceedings of the Eighth International Conference on Creationism*, Creation Science Fellowship, Pittsburgh, PA, pp. 200–216, 2018.
11. Carter, R.W., Lee, S.S., and Sanford, J.C., An overview of the independent histories of the human Y-chromosome and the human mitochondrial chromosome; in: Whitmore, J.H. (Ed.), *Proceedings of the Eighth International Conference on Creationism*, Creation Science Fellowship, Pittsburgh, PA, pp. 133–151, 2018.
12. Klinghoeff, D., Discussion is Over: On Adam and the genome, former BioLogos fellow backs down, Evolution News, evolutionnews.org/2018/05/discussion-is-over-on-adam-and-the-genome-former-biologos-fellow-backs-down/, 3 May 2018.

Deconstructing Darwinism—a theory gone bad, a world gone mad

Charles Darwin: Victorian myth-maker

A.N. Wilson

Harper, New York, 2017



Jerry Bergman

After reading the many negative reviews of this book in leading newspapers and also on Amazon, most of which were written by persons who obviously did not read the book, or at most read only part of it, it was evident to me that the reviewers opposed the author's thesis on philosophical grounds. The few mistakes noted, which it was good to be made aware of are very minor and not unusual in a 448-page small print book.

A.N. Wilson (b. 1950), former professor of medieval literature at Oxford (a lecturer in Britain) is a highly acclaimed biographer. His more well-known works include a pamphlet titled *Against Religion*, biographies of Jesus and St Paul, and a history of atheism in the 19th century titled *God's Funeral*. He has now decided to tackle Darwin. His conclusions were unexpected, both to others and, most surprisingly, to him. The enormous detail in the book slowed me down, but it shows the author did his homework.

If Wilson was a doctrinaire evolutionist, the critics no doubt would have raved about his original work. He actually had been a Darwin believer until he did the research for this book. Wilson was not attempting to glorify Darwin, as many of his biographers do, but included both sides of the man, his good points as well as his warts. I learned much from reading this book, and could check the claims made, given the meticulous documentation (almost 50 pages, from page 373 to page 422) and hundreds of footnotes from original sources.

What may have begun the firestorm against his book was Wilson's prelude, in which he said "Darwin was wrong. That was the unlooked-for conclusion to which I was inexorably led while writing this book" (p. 1). He added that this conclusion "certainly was not my intention when I began detailed reading for this book". But the result of his historical research was "to part company from the mainstream of scientific opinion which still claims to believe, and in some senses does believe, the central contentions of Darwin's famous book, *On the Origin of Species*" (p. 1).

His conclusion was based on the fact that "there is no consensus

among scientists about the theory of evolution", even the central parts of the theory (p. 3). He added that until he began his research he had assumed "scientific opinion accepted the truth of Darwin's central theories, and that objections to it were motivated not by scientific doubts but … most likely religious ones" (p. 3).

He then illustrated this contention by quoting the leading evolutionary scientists, including Harvard's E.O. Wilson and Oxford's Richard Dawkins. One familiar with the field will recognize most of the heated evolution controversies which Wilson accurately relates.

Wilson spent a fair amount of time documenting the sources of the major evolutionary ideas that Darwin implied were his own. For example, in his *The Dialogues,* Hume (1711–1776) attempted to dismantle the argument from design by claiming it amounted to metaphor and anthropomorphic projection (p. 78).

In response to this argument, William Paley wrote his celebrated still-in-print book titled *Natural Theology,* which introduced the well-known story of a traveller who saw a watch lying on the road side while walking. After he picked it up, he immediately realized that a watch demanded a watchmaker. Paley's thesis is similar to the modern Intelligent Design theory.

Likewise, the creation of a world requires a creator. Wilson added that Paley was important to Darwin because it was "almost the only theologian … whom Darwin ever read" (p. 80). It was required reading at Oxford, and Darwin admitted the book impressed him greatly. He later rejected Paley for reasons that remain unclear even today, although much speculation exists as to why.[1]

Wilson included an insightful discussion of Darwin's words to his (Darwin's) very good friend, botanist Joseph Hooker,[2] "it's like committing a murder", namely because by destroying the reason people had for believing in God, Darwin "murdered not just traditional faith but the Creator himself" (pp. 185, 293). The result was, at least in biology, Darwin removed "any necessity for religious explanations" (pp. 186–187).

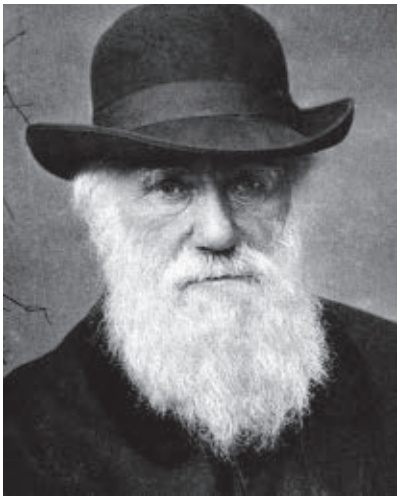


Figure 1. Charles Darwin in 1881, when he was about 71

Darwin's *Origin of Species* changed the world as have few other books. It is essentially a 513-page attempt to refute Paley (pp. 80–82). Wilson argues in the rest of his book that Darwin failed to refute Paley. What Darwin did was to create a myth known as Darwinism, which is why Wilson called him a "Victorian Mythmaker" in his title. Natural selection can only operate on what exists and, as Wilson documents, neither Darwin nor anyone else has been able to explain the *arrival* of the fittest. The most common explanation is mutations, a lethal problem because over 99% are either near neutral, mildly deleterious, or lethal.

Darwin's racism

Wilson also documented Darwin's very negative attitude toward the non-British and non-whites. Aside from the many widely referenced quotes on this topic, Wilson added a few less widely known examples. One is that Darwin believed the British were clearly superior to the "immense mongrel population of Negroes … [he] encountered in Brazil" (p. 105). Furthermore, "the doctrine of European superiority to other peoples of the planet underlay all of his later work on the descent of the human animal" (pp. 105–106). Darwin even believed that "the English were more 'civilized' than, say, the Italians or the Germans" (p. 106).

In some of his many encounters with Negroes (today known as African Americans), Darwin noted that one he met was "uncommonly stupid" (p. 104). The Brazilians were "ignorant, cowardly, & indolent in the extreme" (p. 104). The natives of South America struck Darwin as "more amusing that any Monkeys" (p. 117). He compared the intelligence of the natives he encountered to his domestic pets (p. 300). Darwin felt attempts to civilize the Fuegians was folly (p. 119). He wrote that the South American natives had the "strong odour of negroes, a point of real repugnance" (p. 155). Darwin described the Queen of Tahiti as "an awkquard [sic] large woman without any beauty, gracefulness or dignity of manners" (p. 141).[3] Darwin concluded the Fuegian language was barely articulate, but a list of the Fuegian vocabulary, later prepared by a missionary, included over 32,000 words (p. 300). In *Descent of Man,* Darwin repeated claims that Wilson summarized as follows:

> "… while the cruelty of slavery shocked Darwin, there is no evidence that he believed, either as a young man or as a mature one, in the equality of the human race, whether as a political ideal to be hoped for or as a scientific fact" (p. 105).

Some of Darwin's myths

As an historian, Wilson documented that the supposed insight Darwin

received from his famous Galápagos Archipelago visit is a myth. As the story goes, Darwin noted the finches in the different islands varied in minor ways. Darwin reasoned a few finches had arrived on an island and the different conditions on each island caused them to evolve the differences Darwin noticed (p. 133). Thus, the theory of evolution was born in Darwin's mind.

This mythology was either created or embellished by Darwin's granddaughter, Nora Barlow (p. 133). In fact, Darwin, and even FitzRoy, believed that lifeforms were not created in the exact forms existing today, but had the ability to vary, as all breeders, including Darwin, knew. The question was how much they can vary. It was known even in Darwin's day that much variety was possible, but it was not infinite as Darwin's theory proposed.

Darwin often ignored his debt to others

A theme throughout the book was that Darwin relied heavily on others, such as the highly accomplished naturalist, author, and Museum Curator Edward Blyth, whom Wilson mentions

Figure 2. Erasmus Darwin, Charles Darwin's grandfather, who influenced Charles in the direction of both agnosticism and evolution

numerous times (for example pp. 174–177, 216–218). However, Darwin repeatedly mentioned natural selection and, at other times, evolution as 'my theory', implying that he originated the theory (pp. 180, 192, 194, 342, 353).

As another example, Darwin was exposed to his grandfather Erasmus Darwin's evolution theory (figure 2). Erasmus, "the most famous poet in England" (p. 23), expressed his evolutionary ideas in his book *Zoonomia* and elsewhere in "verses which disposed of the necessity of a creator". It was 'glaringly obvious' to Darwin that his evolution theory was an alternative to Christianity (p. 44). Charles Darwin eventually accepted this alternative theory, and then set out to refute Paley.

Another example is Robert Chambers' book *Vestiges of Natural History of Creation*, which expounded a theory like Darwin's (figure 3). A major difference was Chambers did not include the theory of natural selection. Like Darwin, Chambers argued that the solution to the origin of life is not God but natural laws (p. 193). When Darwin read *Vestiges*, Wilson added that "it was a very great shock to his system" because he "was brought face to face with the uncomfortable truth that his general underlining ideas were not original" and the basic points of *Vestiges* were very similar to his theory—in other words, he scooped Darwin (pp. 194, 195).

His difficulty dealing with criticism

Wilson noted Darwin was close to the then leading British anatomist/paleontologist Richard Owen (1804–1892), but they later became 'bitter enemies', which Darwin claims was due to Owen's "jealousy at my [Darwin's] success". The reason was far more likely due to the fact that Owen was an effective outspoken

Figure 3. Robert Chambers, who wrote one of the first books which detailed the theory that Charles Darwin modified and claimed as his own.

critic of Charles Darwin's theory of evolution by natural selection.

Owen was also critical of Darwin because Darwin largely ignored the previous theories of evolution that had been proposed by others, such as Blyth, a concern that Wilson had. Darwin is also well known for his strong dislike of those who found fault with his theory and were open about their opposition. An example is his former friend George Mivart. Mivart argued, to give one example, that natural selection could not produce structures as complex as the vertebrate eye because the beginning stages of the structure would serve no purpose until all of its essential components were present (we know this as 'irreducible complexity'). Darwin "was horribly discountenanced by Mivart's objections to his theory" (p. 291). As a result of Mivart's valid criticisms, Darwin ruthlessly attacked him in writing. Mivart also opposed eugenics, and Darwin's defence of his (Darwin's) son's work in this area was so strong that not long after Mivart critiqued his son, Darwin formally cut off all communication with Mivart.[4]

Eventually, Darwin became so frustrated with the many valid objections to his theory, which he could not answer, that he abandoned the scientific approach in favour of propaganda (p. 292). The reviews by scientists of the first edition of *Origins* were very often respectful but very critical, and many effectively pointed out the serious problems with the theory. The result was that Darwin simply believed what he could not prove, and the more doggedly he believed, "the more resolutely he basked in Huxley's histrionic public defenses of his theory" (p. 293). Conversely, Darwin's book 'confirmed' in their mind what much of the reading public already suspected, namely evolution was true.

The most useful section of Wilson's book was on Darwin's evolution theory. The last months of releasing his 1859 book caused Darwin intense anxiety due to his major doubts about publishing his work. The manuscript was sent by the publisher to two readers for their assessment. One simply stated that *Origin* "does not prove the theory which it expounds … it is like asking the jury for a verdict without putting witnesses in the box". The reviewer added one of the book's virtues was "it concedes the 'difficulties' of the theory", in chapter 9, so should sell well, a major publishing concern (p. 242). The publisher, John Murray "considered the theory as absurd as contemplating a fruitful union between a poker and a rabbit". Then came the rewriting of *Origin*, and marking mistakes in the proofs, which caused Darwin "bad vomiting" and "great prostration of mind and body … which half killed [him]" (pp. 242–243).

Instead of a second printing, so many new corrections and changes were required that Murray asked Darwin to prepare a 2nd edition, which he did (incurring an extra charge of £72.8d). Many more changes were required for the 3rd edition, which came out in November 1860 (p. 268). And with each revision of *The Origins* "through six editions, he discarded more and more of its central theory" until "the theory itself was in tatters" (pp. 286, 342). So many problems existed that at the end of the 19th century, "'Darwinism' had been all but put to sleep, and science had moved on"; but then, from the "mid-twentieth century onwards, it awoke with all of its mid-Victorian anti-religious trappings" (pp. 286–287).

Incorrect historical claims

Charles openly acknowledged the central role that Malthus played in the development of his own ideas about biological evolution. Darwin even referred to Malthus as 'that great philosopher'.[5] Darwin wrote that when he read Malthus's book on population,

> "… it at once struck me that under these circumstances favourable variations would tend to be preserved, and unfavourable ones … destroyed. The result of this would be the formation of new species."

Darwin concluded that in his day infant mortality was 'very high' and only the fittest could survive in the struggle for life (p. 295).

The fact is, "Malthus's predictions of a struggle for survival by cataclysm could not have been less accurate" (p. 20). Even in England in Darwin's day "where child mortality was painfully high, it was still the case that a huge majority of humans survived childhood" (p. 294). We now know that, "instead of blind struggle, there was ingenuity; instead of selfish grab, there was co-operation; with an increase in population, there actually followed an increase in food" due to better farming techniques and new hybrids (p. 20).

Wilson carefully documents how wrong Malthus was, and when Darwin wrote *The Descent of Man* he should have reflected this reality. In chapter four of *The Descent*, the "Malthusian doctrine is retained in all its nonsensical plentitude" (p. 295). Wilson summarizes this book as follows: "Darwin, when placed beside even the most reactionary or fascistically inclined readers of the twenty-first century, seem[s] simply monstrous", even claiming "the inferior and discarded breeds [of humans] felt no pain as they died" (pp. 296–297).

The gradual evolution problem

A major problem Darwin had, which is still true of Darwinists today, was coming up with evidence for his view that nature does not proceed in leaps, but rather gradually, little by little, as human breeding does. If this was true, all life would be "in a state of infinitely slow evolution to something else", and, as Darwin taught, taxonomy classification would be only temporary—a condition the fossil record simply does not support (p. 249).

This fact contradicts Darwin's main thesis that

> "… natural selection is daily and hourly scrutinizing, throughout the world, every variation, even the slightest: rejecting that which is bad, preserving and adding up all that is good: silently and insensibly working … at the improvement of each organic being" (p. 251).

This problem is why Gould and Eldridge argued for punctuated equilibrium, in which some lifeforms, in geological terms, change rapidly, while at other times they are in a state of stasis. Nonetheless, "all life would be a work in progress, always changing, at least eventually" (p. 250). Wilson reviewed Darwin's book on flowering plants, first published in 1896, noting Darwin recognized that plants "provide

one of the most devastating challenges" to his theory (p. 269).

Wilson documented that the discovery of the laws of genetics were "lethal to Darwinism" in spite of the major efforts to blend the two to form Neo-Darwinism decades later (p. 277). The reason it was a lethal nail in the coffin for Darwin was the problem that Mendelism created for Darwin's gradualism. Darwin recognized this even though, as far as we know, he never read Mendel, and never acknowledged the problem that limited variation could not be overcome, acknowledging: "If this [Mendelism] were *true*, adios *theory*", meaning his theory (p. 279). We now know that because nearly all mutations are near neutral or lethal, and variation is not unlimited as Darwin proposed, his theory was without foundation.

Wilson is very effective in explaining the fallacies of Darwinism. His summary of chapter 3 of the *Origin* is that all life is in a state of constant war with each other, the weak die, the strong survive, but the result is that the healthy and happy thrive. Wilson explains this is like telling children the frightening story that nature is in a constant state of brutal war, but it all ends well because the strong and good lived happily ever after (p. 250).

The effect of the book in Darwin's lifetime

In his lifetime, Darwin never did fully convince the science professors in Britain "though there were those abroad … especially in Germany who became *plus royaliste que le roi* [roughly, more Catholic than the Pope] in their enthusiasm for the survival of the fittest" worldview (p. 241). Darwinism "almost from the first, was widely popular in Germany" (p. 316). Haeckel and others were among Darwin's most active proselytizers, which formed the basis of the social programs "of the Third Reich, culminating in the Holocaust" (p. 316).

In the end,

> "… although Darwin's book would persuade the thinking world … that evolution was true, he would have a harder time persuading the scientific academy that one species could evolve into another … the professors of science were not ready yet to believe that species could mutate [into other species] [but], the thinking public most definitely *was* ready [emphasis in original]" (pp. 241, 245).

Furthermore,

> "… the great majority of scientists, especially in Britain … had rejected evolutionary theory as continental claptrap" (p. 266). In fact, "many of Darwin's most enthusiastic supporters … were Christians. … what was professionally troubling to him, was the difficulty in persuading his fellow scientists" (p. 257).

His close colleague, the eminent botanist Joseph Dalton Hooker (1817–1911), devoted his 1869 presidential address at the British Association for the Advancement of Science to "the fact that Darwin's theory had failed" (p. 280). Darwin's reply to this news from Hooker was that he had at this time partly abandoned his theory of evolution by natural selection in favour of Lamarckism, thus "the *Origin* triumph was not that it was true in detail, but that it made people believe in evolution in general" (p. 281).

Darwin also, in an effort to explain the arrival of the fittest, developed his theory of pangenesis, which was soon refuted.[6] Pangenesis is the idea that all cells in an organism can shed minute particles called gemmules, which circulate throughout the body and finally congregate in the gonads, allowing cells of the parent that undergo changes to transmit these modifications from parents to their offspring.

Darwin's doubts about his theory

Several sections deal with Darwin's personal doubts about his theory. The best example is his constant revision of his *Origin* book in each new edition until the last, the 6th, in which a large number of major changes were made.[7] Burrows concluded that the 1st edition is the clearest and Darwin actually "weakened his argument in an attempt to meet criticisms" in the later editions (p. 256). Quoting Professor Vorzimmer, Wilson wrote that Darwin's history in dealing with the many problems of his theory "is one of documented qualifications and nagging doubts".

Furthermore, Darwin's annotations and marginalia on his copies of the printed articles about topics related to his evolutionary thesis "amount to over a hundred thousand words, and reflect twenty-three years of doubt" (p. 256). As one Darwin biographer wrote, although Darwin was a warrior for his theory for most of his life, he nevertheless "had many moments either of doubting it or (which is different) of not seeing how it could be defended" (p. 256).

Darwin's racist book

Wilson also reviewed Darwin's 1871 book *The Descent of Man*, noting it covered existing differences in people groups, some very racist. Darwin suggested that man could have evolved from some comparatively small animal, like a chimpanzee, or from a powerful one, like the gorilla (p. 302). From this book likely came the speculation that man evolved from apes. Much, or even most, of the book contained material not concerned with humans, but rather insects, fish, birds, reptiles, and amphibians, much of it "scarcely throws any light on the supposed subject of the book, namely the descent of man" (p. 302). Darwin even saw evolution in the behavior of his progeny, concluding that his

[Darwin's] children's enjoyment of hiding in the bushes was due to the "hereditary remains of [the human] savages' state" when we were less evolved (p. 189).

Some of Darwin's claims in this book are simply wrong, such as the statement that a thousand persons a year "were all burnt at the stake" by the church (pp. 178–179 in Darwin). The research puts the number at, at most, 40 per year, not for heresy as Darwin implied, but for behaviour that "Darwin himself hotly disapproved, both on evolutionary and bourgeois principles" (pp. 303–304).

Evolution is the doorway to atheism

As Wilson correctly pointed out, "Darwin had come to disbelieve in Christianity". Although he was unable to openly fully admit his conclusions in this area, in one private letter he acknowledged his hatred toward Christianity (p. 239). As one of Darwin's relatives noted, Charles Darwin and his brothers "were quite unable to understand the minds of the poor, the wicked, or the religious" (p. 327).

Darwin's lack of belief affected his wife, Emma, whose "faith was less vivid than it had been in her youth", according to their daughter, Etty, who herself became "a decided unbeliever" (p. 239). Wilson opines that "It is hard to think of any other branch of modern science … whose proponents spend as much time talking about the errors of theology as of the truth of their own area of expertise" (p. 287). Lastly, the story of mankind's emerging from a long line of primates by survival of the fittest "is now the dominant myth", replacing belief in descent from Adam by both scientists and among the elites of secular society (p. 298). Since the first Adam has been removed from reality, there is no longer any justification to accept the last Adam, Christ (p. 334). In short, Darwin replaced Adam, and concurrently "the deification of Darwin [occurred], both by his few disciples in the nineteenth century and by the many in the twentieth and twenty-first" (p. 366).

Wilson documented that Darwinism had become a religion. It was spoken of as a faith, and those who rejected the view that the origin of humans was purely natural, including the co-founder of the theory, Alfred Russel Wallace and St George Mivart, were excommunicated from the tribe, the loyal circle of Darwin supporters (pp. 319, 325, 338). Wilson adds that "the worship of Darwin as a man … is all necessary to bolster the religion of Darwinism" (p. 347).

The veneration Darwin had achieved is illustrated by a note he sent to a complete stranger, sold at an auction in 2015. The note, expected to fetch between 70 and 90 thousand dollars, sold for $197,000. This amount was $4,800 per word for a few common words written in November of 1880 that Darwin penned to tell the writer he did not believe the Bible was a divine revelation, nor that Jesus Christ was the son of God (pp. 351–352). In the end, it was Darwin, more than any other man, that persuaded much of the academic world that "'special creation' was wrong and 'evolution' was right" (p. 360).

Conclusions

In conclusion, this is one of the best biographies of Darwin I have read. It covers enormous detail and, although parts are laudatory of Darwin, as a whole it is very balanced and well-supported, with references to the letters and books penned by Darwin and his family and friends. Wilson even covered Darwin's endless health problems, adding one more theory to the mix—lactose intolerance, which seems to fit his symptoms and the situations in which he became ill (p. 273).

He also covers the harm Darwin has caused to society, writing that "Darwin was a direct and disastrous influence, not only to Hitler, but on the whole mid-twentieth-century political mindset" (p. 346). Furthermore, "Darwinism, as is shown by the current state of debate, is resistant to argument because it is resistant to fact" (p. 347).

References

1. See Sulloway, F.J., Why Darwin rejected intelligent design, *J. Biosciences* **34**(2):173–183, 2009.
2. Letter to Hooker dated 11 January 1844; in: Burkhardt, F. (Ed.), *The Correspondence of Charles Darwin,* vol. 3, Cambridge University Press, Cambridge, p. 2, 1987.
3. Darwin, C., Diary of the voyage of the H.M.S. Beagle; in: Barlow, N. (Ed.), *The Works of Charles Darwin, vol. 1*, New York University Press, New York, p. 325, 1987.
4. Adrian, D. and Moore, J., *Darwin: The life of a tormented evolutionist,* Time Warner Books, New York, p. 613, 1991
5. Barlow, N. (Ed.), *The Autobiography of Charles Darwin*, Norton, New York, p. 120, 1958.
6. See Bergman, J., *The Dark Side of Darwin*, New Leaf Press, Green Forest, AR, chap. 10, pp. 187–210, 2011.
7. According to Charles Darwin in the sixth edition of the *Origin of Species* edited by J.W. Burrow (Penguin, New York, 1985), as quoted by Wilson on p. 256.

Turtle evolution turns turtle

Turtles as Hopeful Monsters: Origins and evolution

Olivier Rieppel

Indiana University Press, Bloomington, IN, 2017

John Woodmorappe

Author Olivier Rieppel is identified as the Rowe Family Curator of Evolutionary Biology at the Field Museum in Chicago. He has more than 350 scientific papers and eight books to his credit, and is on the editorial board of several peer-reviewed scientific journals.

This book is about much more than the alleged evolution of turtles. It touches on various aspects of evolutionary theory, and candidly entertains positions on the philosophy of science that are quite similar to those of scientific creationists.

The rebirth of evolutionary 'hopeful monsters'

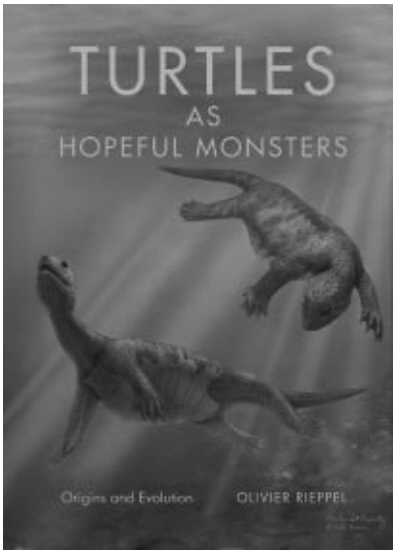
The 'hopeful monster' idea posits that major evolutionary changes occur not from long-term step-by-step alterations, but from massive changes, in multiple organ systems, in an organism, within a single generation. Most of these monstrosities quickly die out, but (supposedly) a few live on as radically new organisms.

In accordance with Rieppel's jargon, the transformationist perspective closely maps with the traditional neo-Darwinian view of evolution as a step-by-step process of the accumulation of beneficial mutations by natural selection—an adaptationist chain of long-term, generally gradual events that eventually lead to a novel organism. In other words, given enough time, microevolution becomes macroevolution. The transformationist perspective emphasizes paleontology in the understanding of (presumed) evolutionary change, and focuses on the (presumed) transformation of one organism into another over time. This is best exemplified by the (presumed) transition-filled evolutionary sequences, notably the therapsid-to-mammal and theropod-to-bird ones.

By contrast, the emergentist perspective sees evolution as primarily the changes that occur in the developmental programs that regulate the development of adult traits. Because these (presumed) changes can happen simultaneously, 'instant' macroevolution of a new organism can (presumably) take place, without transitional states from the ancestral organism, thus fulfilling Richard Goldschmidt's old 'hopeful monster' hypothesis (hence the title of this book). The emergentist perspective emphasizes embryology in the deduction of how these (presumed) changes have taken place in the distant past. However, as elaborated below, embryological clues to (presumed) evolution are not self-evident: They rely on a good dose of special pleading.

The transformationist and emergentist perspectives overlap considerably. Rieppel comments:

> "One of the major differences between the emergentist and transformationist paradigm is that the latter, but not necessarily the former, allows, or even seeks, to arrange adult organisms in a transformation series of ancestral and descendant conditions to form putatively documented continuous morphological change. That way the ancestral and descendant conditions of form are bridged by an unbroken series of intermediate steps, as is required according to the Darwinian theory of evolution through variation and natural selection. Such intermediate steps in evolutionary change may *sometimes* be gleaned from the fossil record and *sometimes* from embryonic development [emphasis added]" (p. 152).



The splitjaw snake: hopeful monster or wishful thinking?

An unusual, rare bolyeriid snake, *Casarea dussumieri*— at one time grouped with the boas— has, instead of the usual single upper jawbone (maxilla), two disconnected upper jawbones connected by a hinge. Although now many decades old, the splitjaw snake is brought up by Rieppel as an iconic example of the evolutionary hopeful monster mechanism in action.

A close examination of the evidence shows that this unusual intramaxillary joint is not synovial, and that it contains no articular cartilage. The abutting edges of the bones are not shaped for a precise fit, and the now-two bones are loosely connected by a strap ligament.[1] It appears that, far from qualifying as a 'second jaw' (in some way), much less a hopeful monster, the splitjaw morphology is a greatly overhyped feature.

There is suggestive (not conclusive) evidence that the splitjaw morphology gives its bearer a selective advantage. It enables the upper jaw to 'curl around' (encircle) the skink prey, held transversely in the jaw, which could otherwise slip away.[2] Is this profound or trivial? What if some other craniofacial defect—such as heritable forms of cleft palate in humans and animals—sometimes conferred a selective advantage to its bearer?

Let us, for the sake of argument, imagine that the freak splitjaw morphology is both anatomically and functionally a 'second jaw'. The reader is asked to imagine a human born with an extra set of functional knees: the regular knee that joins the femur with the tibia/fibula, along with a second full-fledged knee, superior (headward) to the first, and forming a hinge within the femur. Moreover, what if this 'second knee' gave its bearer an advantage in certain circumstances—as, for example, a stellar career in acrobatics?

Would the 'second knee' mean that the person having it is no longer human, and is now a 'hopeful monster' that belongs to its own, new, higher taxonomic category? Hardly. In like manner, no one even tries to suggest that the splitjaw belongs to its own, higher taxonomic category. It is still a snake, and is universally recognized as one.

Finally, any would-be 'second jaw', just as the hypothetical 'second knee', is a duplicated structure, not a novel structure. It hardly qualifies as a 'hopeful monster' in the customary sense of the word, much less as anything comparable to the reorganization in development that would hypothetically transform a non-turtle into a turtle in one generation!

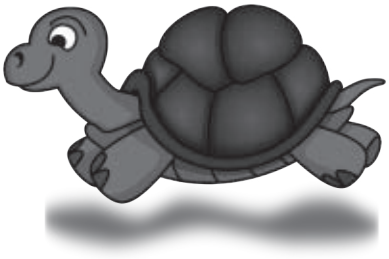


Figure 1. A cartoon version of the turtle, exemplifying the ways this unusual reptile captures the human imagination.

By citing the bolyeriid snakes as 'hopeful monsters', it appears that evolutionists are clutching at straws. Here we are, some 65 years after their discovery, and the bifurcated upper jaw of bolyeriid snakes actually passes, in Rieppel's own words, as the "most frequently cited example of hopeful monster in vertebrates" (p. 119). If this is the best that evolutionists can do, then evolutionary theory in general, and the 'hopeful monster' mechanism in particular, must be intellectually poor indeed.

Contradictory 'phylogenetic signals' on the relative placement of turtles

Molecular data places the turtles as a sister group to the Archosauria (that is, Aves and Crocodylia), while micro RNA data instead places turtles as a sister group to the Lepidosauria (*Sphenodon punctatus* (the tuatara) and Squamata (lizards and snakes)).[3] Rieppel seconds this conclusion, and makes no attempt to belittle its significance:

> "There is an obvious discrepancy in the signals concerning turtle relationships generated by comparable anatomical versus molecular studies—a discrepancy that still has no satisfactory explanation today" (pp. 59, 187).

In the past, creationists were ridiculed for questioning the ancestor-descendant relationships shown in textbooks as fact. Now the cladistic revolution has induced evolutionary thinking to catch up, in this respect, with creationism: "The search for ancestors was rejected as dilettante science; instead the search for sister groups became all the range" (p. 4).

Odontochelys: outstanding evolutionary evidence, or over-hype?

The author claims that the recently discovered Chinese Late Triassic *Odontochelys* is a dramatic find, in that it has a plastron (figure 2) but not carapace, proving that the plastron evolved first, and that this plastron-first appearance is exactly what we see in modern turtle embryos.

However, even within the confines of evolutionary ideation, the alleged 'half-turtle' *Odontochelys* can be interpreted in a decidedly less exciting manner—as an unremarkable, aquatic-specialized turtle that moreover does retain elements of the carapace, in a manner similar to that of some modern aquatic turtles. Reisz and Head[4] comment:

> "Thus, an alternative interpretation is that the apparent reduction of the carapace of *Odontochelys* resulted from lack of ossification of some of its dermal components, but that a carapace was indeed present. This interpretation of *Odontochelys* leads us to the possibility that its shell morphology is not primitive, but is instead a specialized adaptation.

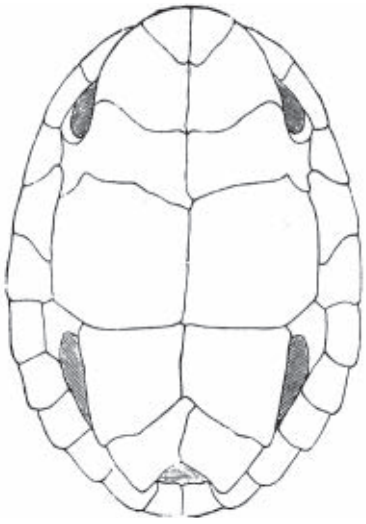


Figure 2. The plastron, the ossified underside of the turtle, is, according to both embryology and the Upper Triassic *Odontochelys*, supposed to have evolved before the shell (carapace) itself.

> *Reduction of dermal components of the shell in aquatic turtles is common*: soft-shelled turtles have a greatly reduced bony shell and have lost the dermal peripheral elements of the carapace. Sea turtles and snapping turtles have greatly reduced ossification of the dermal components of the carapace, a condition similar to that seen in *Odontochelys* [emphasis added]."

What about the role of *Odontochelys*, the presumed evolutionary origins of turtles? Not much, as it turns out. In order to avoid getting caught up in semantics about so-called evolutionary transitional forms, I let Rieppel speak about the status of *Odontochelys*:

> "The mystery of mysteries that still awaits resolution concerns the sister group relationships of turtles among reptiles, diapsids in particular. Such sister group relationships are generally revealed through shared evolutionary innovations. It is thus not the many primitive characteristics of *Odontochelys* that promise to reveal the sister group characteristics of turtles, because many other reptile groups may share the same primitive features—teeth on the upper and lower jaws, for example. What would be required for the resolution of the sister group relationship of turtles would be for *Odontochelys* to share some evolutionary innovation with some other reptile group outside turtles. In that respect, *Odontochelys* remains silent. Those evolutionary innovations that it does have are the same that characterize later, as well as modern, turtles" (p. 187).

A closer look at evolution in the light of the embryology of turtles

What of the presumed fulfilled embryological prediction concerning the plastron-first *Odontochelys*? Apart from the ambiguous interpretation of *Odontochelys*, elaborated in the previous section, the reader must remember that those evolutionists who held to other theories of turtle origin were evidently not impressed with the plastron-first embryological development in turtles. Therefore, the sudden attention to the plastron-first embryology appears to be more an after-the-fact 'discovered significance' than a prediction. In any case, it bears repeating that "Such intermediate steps in evolutionary change may *sometimes* be gleaned from the fossil record and *sometimes* from embryonic development [emphasis added]" (p. 152). Clearly, the invoking of embryology, for the inference of presumed one-time evolutionary stages, even those seen in the fossil record, is more in the realm of special pleading than sound methodology[5].

Let us now consider the putative embryological evidence for the presumed evolutionary degree of the relatedness of the turtles to various extant reptile groups. For decades, the modified fifth metatarsal in turtles (hooked element) has been used as a synapomorphy to group turtles with certain other reptiles. Recent embryological analysis suggest that, rather than being the fifth metatarsal, it is instead an enlarged fifth distal tarsal. However, the same evidence can actually be interpreted as supporting the original metatarsal identity.[6] Note also that distal tarsals generally ossify endochondrally (through replacement ossification) while metatarsals ossify perichondrally (through non-replacement ossification). However, this does not necessarily resolve the issue, because exceptions to this generalization are known. All of the foregoing, at the very least, shows that deductions from embryological evidence are quite interpretive in nature, and that they partake of deductive reasoning that assumes the fact of evolution.

The following statements by Joyce *et al.*[7] are especially revealing:

> "It is apparent, however, that primary homology is not deduced from the absolute timing of chrondrification or ossification, *but rather from changes in this sequence relative to ancestral conditions*, as inferred through outgroup analysis [emphasis added]."

Clearly, then, embryology, on its own terms, is not a line of evidence that is independent of phylogeny: it assumes both the fact and the veracity of the phylogenetic reconstructions, and moreover requires a 'shopping around' for presumably relevant evidence.

As is the case with adult traits, when all else fails, the evolutionist can always invoke convergence for traits in the embryo. As evolutionists debate the presumed significance of the embryological evidence, they are willing to contemplate such things as the independent origins of the hooked element in unrelated reptiles or the secondary reversal of this trait in reptiles that presumably once had them.[8]

Given enough instances, and looking hard enough while manipulating the evidence diligently enough, one could eventually 'see' an evolutionary development in all sorts of embryological developmental pathways. In conclusion, embryology can be like palmistry. Given enough imagination, combined with enough selectively chosen anecdotes of success, one can reasonably deduce that the creases in one's palm are 'signposts' of one's situation in life. In like manner, embryological events can inventively be made into 'signposts' of past evolutionary events.

The new emergentist just-so stories join the old transformationist just-so stories

By way of introduction to this subject, Rieppel comments:

> "The tools in this case are the genes, but as the case of turtles illuminates, the same genes can do different things in different contexts or locations. It is obviously entirely

possible to recruit old genes, which, in a different context and location, can perform new tricks … . Old genes performing new tricks in a different context or location is a classic mechanism of evolutionary innovation ... . Innovation here does not mean the mere transformation of an ancestral structure into a modified, descendant one, but rather means the emergence of an evolutionary novelty through the reprogramming of embryonic development, resulting in the formation of a carapace, the hallmark of a novel body plan" (p. 151).

We again are dealing with evolutionspeak, otherwise known as evolutionistic 'cover words'. Is this 'old genes doing new tricks' meme something that is known to happen, or is it something that is *assumed* to have happened? The answer is rather obvious. Recall that, in classical neo-Darwinism, 'survival of the fittest' (an obvious truism) is confused with 'arrival of the fittest' (a supposition), and moreover 'an organism is adapted' (an obvious truism) is confused with 'an organism is adapted because of endless mutations filtered by natural selection' (a supposition). Now it is more of the same. Only this time, 'the same genes perform different functions in different organisms' (an obvious truism) is confused with 'the same genes perform different functions, in different organisms, because of one or more radical reorganizations of developmental pathways in the past' (a supposition).

Finally, Rieppel (p. 146) is candid about the fact that known embryological anomalies tend to be stereotyped in terms of their outcomes, which points to 'forbidden pathways' in development. Although not mentioned as such, this weakens the argument that errors in embryological development could serve as a viable mechanism for viable and novel hopeful monsters.

Creationists are right about comparative anatomy, homology, and inferred ancestor-descendant relationships

Although evolutionist Rieppel is in no sense supporting creationism, his helpful historical survey confirms what creationists have long been saying. I focus on three items.

To begin with, the practice of comparative anatomy not only is compatible with creationism, but actually began under creationism, and moreover with evolution very much a latecomer. Rieppel tacitly recognizes as much:

"At the time of Linnaeus's writing, the term 'affinity' was meant to express degrees of structural similarity, not evolutionary relationships, the latter a connotation that the term 'affinity' acquired only later, most prominently through the influence of Charles Darwin" (p. 33).

Now let us ponder the fact that homology is not evidence of evolution. Homology *assumes* the existence of evolution. Moreover, even within the mental box of evolutionary thinking, homologies cannot be proved; only supposed. Rieppel comments:

"A prerequisite for all classifications that are meant to represent evolutionary (phylogenetic) relationships is certainly the correct identification of homologies. That depends on the one hand on a comparative method that allows us to pinpoint corresponding parts, or organs, in two or more organisms that could be homologues. Beyond that, however, homology implies common ancestry, and *in the absence of a time machine, the latter implication cannot be confirmed through observation.* The relation of homology therefore does not obtain from raw observation alone. Instead, while ultimately rooted in a comparative analysis of anatomy, *it nevertheless remains to a large degree a hypothetical relation* [emphasis added]" (p. 64).

Macroevolution is not just microevolution writ large

One implication of inferred evolutionary 'hopeful monsters' is as follows:

"In light of these discussions, it became obvious that the reconstruction of evolutionary relationships in essence boils down to the study of the evolutionary transformation of characters, that is, of those characters that mark out taxonomic units of lower or higher rank may be subject to different evolutionary mechanisms" (p. 103).

Are evolutionary theories testable?

This book has a fascinating section on evolutionary theory in the light of the philosophy of science. In many ways, it echoes creationists.

The hallmark of science is the testability (falsifiability) of its theories. Decades ago, creationists (e.g. the immortal Duane T. Gish) had noted that evolutionary theories cannot, strictly speaking, be tested, at least not the same way that the effects of a chemical can be tested in the laboratory. Interestingly, author Rieppel comes to much the same conclusion. He writes:

"Because experimental sciences, such as chemistry and physics, deal with processes that—in general and within certain limits—are reproducible, such testing of published results is routine, especially if they are deemed suspicious for one reason or another. In sciences that are not experimental, the confirmation or falsification of any purported insight or theory is much harder" (p. 154).

Evolutionary theories are admittedly subjective and imagination-driven

Rieppel continues:

"Testing theories of comparative anatomy or comparative

> embryology is likewise hugely messy. Comparative anatomy weighs the degrees of similarity or dissimilarity of organs or organ systems in the plants or animals under comparison, but many say that similarity ultimately lies in the eye of the beholder. What looks similar to one investigator may look dissimilar to another … . But how similarity should be measured—this is where the disagreement arises … . Comparative anatomy is notorious for carrying on endless debates about potential homology relations and their significance for the reconstruction of the tree of life. The endless debates about the evolutionary relationships of turtles are just one notorious example among many" (pp. 154, 155).

Groupthink and politics behind evolutionary theories

The reader who supposes that evolutionary theories are 'all about the evidence', as dogmatically claimed especially by anti-creationists, is in for a rude awakening upon hearing what Rieppel has to say. His words are also a stinging rebuke to those who say that "Presuppositions do not matter". Not only do they matter, they are crucial! Thus, Rieppel writes:

> "In sketching the history of the alternative theories invoked to explain the evolution of the turtle shell, it is important to understand that this (still ongoing) debate is not fueled by whatever observations have been made or are being made or are being made by the use of ever more sophisticated techniques. The debate is also, and just as much, fueled by *the way the observer looks at nature in search for evidence bearing on the problem* of the origin of the turtle shell—whether from a transformationist or an emergentist perspective [emphasis added]" (p. 125).

As if trying to make sure that he is not making an understatement, author Rieppel makes his foregoing conclusion even stronger as he says:

> "But methods, and the rules and rulers they prescribe, are not things observed in nature. They are instead things that scientists, or groups of scientists, collectively agree on, then collectively apply to nature. Remember science philosopher Karl R. Popper, who compared the scientific community, or competing parts thereof, to a jury. In the cladistics revolution, competing groups of scientists—the conservative and the progressive—would form adverse juries: they would get on the telephone, lobby to form interest groups, and establish new professional societies that would publish new journals, in defense and support of their competing views. Put that way, the picture that science paints of the world is one that is no longer only and entirely determined by objective observation. *This is because those observations will be evaluated, and will gain significance, only in light of methods that are subject to political maneuvering among scientists and their struggle for financial support from foundations and granting agencies* [emphasis added]" (p. 155).

And yet we still hear complaints that "creationists do no real scientific research"!

Evolutionary theories as social constructs

Author Rieppel drives the final nail in the coffin of the "value-free nature of evolutionary science", as he concludes:

> "At the end of the day, what counts is a collective agreement among groups of scientists to use one but not the other method in the evaluation of observations. What this all boils down to is the idea, forcefully defended by a number of philosophers of science, that *the picture that some sciences paint of the world is certainly not entirely, but sometimes to a remarkable degree, socially constructed* [emphasis added]" (p. 155).

Conclusions

The presumed evolutionary affinities of turtles remain enigmatic. Embryological data, assuming its relevance to presumed evolution in the first place, is fraught with interpretative subjectivity and special pleading. The highly touted 'half-turtle' fossil *Odontochelys*, rather than a vindication of evolution, may be little more than a specialized aquatic turtle.

The new emergentist view of evolution is no better, from an evidentiary point of view, than the old transformationist view. Both rely on *post-hoc* reasoning, and assume, rather than demonstrate, the evolutionary outcomes that they are asserting.

Questions about the scientific nature (or deficiency thereof) of evolutionary theory, the testability or non-testability of evolutionary deductions, etc., have long been raised by scientific creationists. Now evolutionists are catching up and asking them also.

Evolutionary thinking is governed by groupthink as much as it is by the presumed evidence. No wonder that scientific creationists generally do not get a fair shake in academia!

References

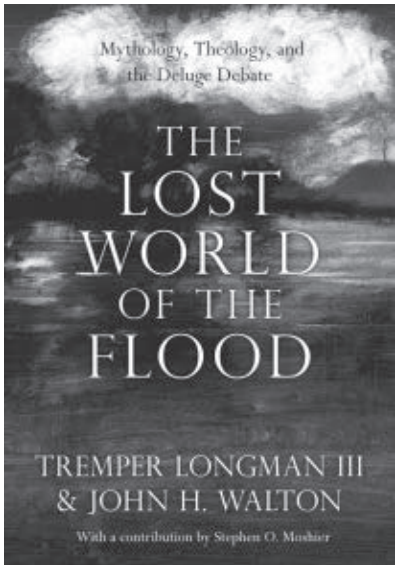
1. Cundall, D. and Irish, F.J., The function of the intramaxillary joint in the Round Island boa, *Casarea dussumieri*, *J. Zoology* **217**:569–598, 1989 | doi:10.1111/j.1469-7998.1989.tb02512.x.
2. Cundall and Irish, ref. 1, pp. 576, 592–593.
3. Joyce, W.G., Werneburg, I., and Lyson, T.R., The hooked element in the pes of turtles (Testudines): a global approach to exploring primary and secondary homology, *J. Anatomy* **223**:421–444, 2013 | doi:10.1111/joa.12103.
4. Reisz, R.R. and Head, J.J., Turtle origins out to sea, *Nature* 456:450–451, 2008 | doi:10.1038/456450a.
5. Woodmorappe, J., The cephalopods in the creation and the universal deluge, *CRSQ* **15**(2):94–112, 1978.
6. Joyce *et al.*, ref. 3, p. 429.
7. Joyce *et al.*, ref. 3, p. 432.
8. Joyce *et al.*, ref. 3, pp. 434–435.

The Flood was historically global, not hyperbolically global

The Lost World of the Flood: Mythology, theology, and the deluge debate

Tremper Longman III and John H. Walton, with a contribution by Stephen O. Moshier

InterVarsity Press, Downers Grove, IL, 2018



Keaton Halley

It was bound to happen eventually. The account of Noah's Flood has now been subjected to John Walton's interpretive method, which was previously set forth in other books from his influential 'Lost World' series. This latest installment by Walton, professor of Old Testament at Wheaton College and Graduate School, was co-authored with Tremper Longman III, Distinguished Scholar of Biblical Studies at Westmont College.

In the same way that Walton previously insisted that Genesis tells us nothing about the material origins of the universe or the biological origins of humanity,[1,2] Longman and Walton now claim that, although the Flood was a historical event, the biblical text does not provide a *description* of the actual event. Instead, Scripture only tells us about the Flood's theological *meaning* using figurative language. Longman and Walton maintain that the Flood is depicted *literarily* as a global event, but this is intentionally hyperbolic language employed only to highlight the Flood's great significance. As a historical event, they say, the Flood cannot have been global, because this is precluded by the geologic record.

But, as will be shown, this revisionist understanding of Noah's Flood is ultimately unfaithful to the inspired text. The Bible does not merely depict the Flood as hyperbolically global, but historically global.

Tangential topics

Longman and Walton address a variety of other subjects associated with the Flood as well, such as Cain and Abel, the Genesis genealogies, the Nephilim, Babel, geological evidence, and widespread cultural flood legends. For sake of space, this review will focus on their primary case for a hyperbolic Flood, and leave these supplemental concerns to be addressed by others.[3]

Useful concessions

Though Longman's and Walton's understanding of the Flood account is generally at odds with the church's historic view of the Flood as a real, global, catastrophic disaster, it does align at various points. This is helpful to creationists, because we can allow our critics to make our case for us! For example, Longman and Walton say that the *toledot* structure of Genesis shows that it was intended to record a "sequence of past events" (p. 17). Likewise, the authors insist that the Genesis Flood story was not borrowed from Babylonian myth (p. 80).

Regarding the extent of the Flood, they affirm many arguments creationists have long used to show that the text describes a global Flood. Longman and Walton think that the narrative as a whole is hyperbolic, but they argue strongly that the Flood is *depicted* as worldwide, not local. They insist that the following points prove the worldwide nature of the Flood (pp. 45–49):

- All of humanity was destroyed, which could not be accomplished by a regional flood.
- Noah needed to take animals, including birds, on board.
- God told Noah to build an enormous Ark rather than instruct him to move.
- The sources for the water (all the springs of the great deep, floodgates of the heavens) indicate universality.
- The water was deep enough to cover the mountains (including the region of Ararat) by 15 cubits.

Furthermore, Longman and Walton offer multiple reasons why, according to the account's portrayal, the Flood must have killed all of humanity except for the Ark's eight passengers:

- Human sin was universal (pp. 45, 48).
- The Flood was the solution to God's regret over creating mankind (pp. 45, 48).
- The judgment was a reversal of creation—a 'do-over' (pp. 46, 48–49).

- The text describes a worldwide Flood, which would leave no survivors (p. 45).
- The text uses "universalistic rhetoric" to portray all people and animals as destroyed by the Flood (p. 70).[4]

Bait-and-switch propositions

Unfortunately, many of the book's 17 chapter titles, called "propositions", are misleading. What is argued in the text of the chapter often goes well beyond the stated thesis. For example, here is Proposition 1: "Genesis is an Ancient Document". How banal. Who disagrees? But this chapter actually discusses the Bible as a whole, not just Genesis. Also, it leaps from the reasonable claim that we must understand the Bible according to its historical context to assert these non sequiturs: (1) the Bible does not intend to teach any science, (2) its authority does not extend to science, and (3) it contains scientific falsehoods. Thus, a more accurate title for this chapter would have been: "The Bible's divine authority does not ensure that it accurately describes the world". But methinks that would have given away the game.

Proposition 2 is: "Genesis 1–11 Makes Claims About Real Events in a Real Past." Again, no disagreement there. But a more accurate title would have been: "Genesis 1–11 makes reference to real events, but it emphasizes their spiritual meaning over historically correct descriptions."

Proposition 3 is: "Genesis 1–11 Uses Rhetorical Devices." What they meant was: "The figurative language in Genesis 1–11 is so pervasive that it prevents us from reconstructing any past events mentioned therein."

Limiting biblical authority

Despite Davis Young's blurb on p. ii, which praises the authors for their "evangelical high view of Scripture", Longman and Walton don't have one. Sure, they profess to believe in inerrancy, and they rightly say that inerrancy applies to all that the Bible "intends to teach" (p. 167). But, for them, these are weasel words, because these authors severely constrict what they'll allow the Bible to intend to teach. They say the Bible's "affirmations are not of a scientific nature" (pp. 10–11). Ironically, Longman and Walton are the ones imposing a modern secular/sacred dichotomy on the text, so that even though the Bible is replete with factual descriptions of nature and historical events, only the 'spiritual meaning' carries the authority. In the author's minds, then, the Bible can wrongly say that the earth is flat (p. 153), that the sky is solid (p. 11), and that our hearts help us to think (p. 9), yet somehow without affirming such things. However, this is not the way Jesus and the New Testament authors viewed Scripture, as demonstrated by the fact that they treated historical and scientific details in Old Testament narratives as reliable revelation.[5]

Longman and Walton also approvingly cite the Chicago Statement on Biblical Inerrancy, when it suits them, to rightly defend the Bible's use of hyperbole (pp. 34–35). But, they seem to have skipped Article XII, which says:

> "WE DENY that Biblical infallibility and inerrancy are limited to spiritual, religious, or redemptive themes, exclusive of assertions *in the fields of history and science*. We further deny that scientific hypotheses about earth history may properly be used to overturn the teaching of Scripture on creation *and the flood* [emphasis added]."[6]

A statement made repeatedly throughout the book, so often that it becomes a mantra, is, "The events are not inspired but rather their presentation and interpretation in the biblical text are" (p. 92, cf. 12, 18, 93, 95, 177). One wonders who Longman and Walton are attempting to argue against here. Creationists do not say that the Flood event itself is the object of inspiration. This would be a category error. God breathes out authoritative words (2 Timothy 3:16), but events are not words. Nevertheless, when Longman and Walton apply this notion to the Flood account, they say, "There was a real, cataclysmic event, but the Bible does not *describe* that event authoritatively", while it "does *interpret* that event authoritatively [emphasis in original]" (p. 11). So, then, they see the description given in the text as some combination of two possibilities. First, it may be that the description of the Flood is factually wrong, though not authoritative (fitting in their category of 'culturally conditioned'). Second, it may be that the description of the Flood is not intended as a literal description (fitting in their category of 'rhetorically shaped'). However, the driving assumption behind these false alternatives is that Scripture cannot authoritatively communicate anything that may be subjected to scientific analysis. But what if God wanted to? He doesn't have to reveal the quadratic equation in order to say something that would qualify as science. He could simply state that water once covered the mountains by 15 cubits, which is exactly what He did.

Hyperbole hypothesis is a stretch

Though Longman and Walton maintain that "Only the most gullible" would deny the hyperbolic nature of the Flood (p. 39), let me risk their contempt. I do not deny that there are some hyperbolic elements in the Flood narrative, like their example from Genesis 6:5, which describes the wickedness of mankind by saying that "every intention of the thoughts of his heart was only evil continually" (p. 38). As Longman and Walton point out, surely not every motive for every

thought was wicked, including those of righteous Noah (Genesis 6:9). Still, the claim that the extent of the Flood was exaggerated for effect is utterly unconvincing.

Poor parallels

One problem is that the authors' examples of hyperbole are disanalogous to the Flood account. On p. 49, they say the language in the Flood narrative is like describing the Holocaust as the "total annihilation of European Jewry". But, as is typical with hyperbole, this is a simple exaggeration of size/scope within a single, short statement. The Flood, by contrast, is a complex narrative carried through several chapters, with multiple, varied indications that the event was actually worldwide and wiped out all of humanity.

Or, take the authors' example of the Israelite conquest in Joshua 1–12. In several summary statements in Joshua 10 and 11, it says that "Joshua took the entire land" and "left no survivors". But in Joshua 13 and Judges 1, much territory still remained to be conquered. Longman and Walton say:

> "The author is intentionally using universalistic language and intends to convey, rhetorically, that the conquest was complete, but that did not correspond to the actual geographical scope of the conquest, only to the significance of the conquest" (p. 32).

I grant that some of the phrasings are hyperbolic because the author of Joshua is focusing on the victories, but that is not to say that the specifics of the account are ahistorical. The text describes in accurate detail which areas were conquered and which kings were defeated. So, what we have here are islands of hyperbole in a larger non-hyperbolic narrative.

But note that this is not what Longman and Walton are claiming about the Flood account. They say that the real (local) flood event is so obscured by the hyperbole that "we cannot reconstruct the event" (p. 146). They say that all of the elaborate detail in the Flood narrative is not meant as a historical description. It's all just part of the rhetorical shaping of the story. Really?

Let's consider some of these details. Longman and Walton dismissively say that many of the specifics in the Flood account, like the duration of the Flood and the precise size of the Ark, "are incidental and don't matter" (p. 63). But how do they know this? Dismissing the details is a convenient way of not having to account for their presence. But it makes far more sense if the following were recorded due to the fact that they are historical realities.

- The Ark was 300 × 50 × 30 cubits, was made of gopher wood, had 3 decks, one door, a roof, a window, and was covered inside and out with pitch.[7]
- Animals went on in pairs (unclean) and sevens (clean).
- The mountains were covered by 15 cubits.
- The Ark landed specifically in the region of Ararat, which Longman and Walton acknowledge is a location uniquely given in the biblical account (p. 80).
- An elaborate chronology for the Flood year is given with precision down to particular days in specific months in a specific year of Noah's life.
- Noah released particular birds in a particular order.

If these kinds of details do not correspond to reality and serve no particular purpose, the account is filled with extraneous twaddle. Longman and Walton say you can tell that a passage is figurative when you "have to work hard to take it any other way" (p. 25) but, here, they are the ones having to dance around the plain sense of the text.

Truncated Noahic covenant

Another problem for Longman and Walton is that God's dealings with Noah after the Flood indicate that it was worldwide. The authors do offer an interpretation of the Noahic covenant, which is true as far as it goes. They say it highlights God's continued grace toward sinful creatures (p. 103). It represents God's commitment "to the continuance of the world and its inhabitants" (p. 104). It indicates "a re-establishment of" and "greater permanence to the cosmos's order" (p. 120). Okay. Fine. Good. But there's more.

God's promise was not merely that He would now preserve the world, it was that He would not repeat such a Flood (figure 1). He said, "never again shall all flesh be cut off by the waters of the flood, and never again shall there be a flood to destroy the earth" (Genesis 9:11; cf. 8:21; 9:15; Isaiah 54:9). But what was God promising not to repeat in Longman

Figure 1. God's covenant to never flood the world again was made not only with Noah, but "all future generations" (Genesis 9:12). This implies that the worldwide Flood occurred in the real past and was not merely a literary device.

and Walton's view? Although they don't say, I suspect they would agree that God was promising not to send another worldwide Flood. But this means, in their view, that even this promise must be part of the hyperbole. In other words, it's not part of the inspired meaning we can derive from the account; it's just part of the furniture of the literary device meant to emphasize God's gracious commitment to preserve the world. On the contrary, the text explicitly says that God was making this covenant not only with the characters in the narrative—Noah, his family, and the animals—but also with their future "offspring" (Genesis 9:9) and "for all future generations" (Genesis 9:12). God promised *us* that He would never flood the entire world again, which means He once did so in real history.

Survivors outside the Ark?

As mentioned earlier, Longman and Walton admit that the Flood narrative describes the reduction of the world's population down to eight. But they do not believe this really happened in history. They say it is only "one reading of the story" which understands Noah and sons "to be the ancestors of everyone who is alive today" (p. 162). Plus, given their acceptance of the conventional millions-of-years age of the earth, "there was no time when all humans were concentrated in a specific area so that even an extensive, regional flood could wipe them all out" (p. 46). Therefore, in their view, many others besides those on the Ark survived the actual, historical flood.

But this is contrary to the text. The Bible emphasizes in a variety of ways that only Noah and his family remained after the Flood. These simply cannot all be chalked up to the aggrandizing of the Flood's significance. For example, Noah and sons were commanded to "Be fruitful and multiply and fill the earth" (Genesis 9:1; cf. 9:7)—the same command God gave to Adam and Eve (Genesis 1:28) because Noah was likewise beginning from scratch. Also, Noah's sons gave rise to the "nations" (*goyim*), which spread around the "whole earth" following the Flood (Genesis 9:19; 10:32). Finally, the New Testament treats it as a given that God "did not spare the ancient world, but preserved Noah … with seven others" (2 Peter 2:5; cf. 1 Peter 3:20). So, the notion that the Flood destroyed everyone extends well beyond the immediate context of the Flood account. It is treated as a factual, historical truth in all that follows.

Peter's perspective

Longman and Walton say that the New Testament references to the Flood treat it as merely "an illustration of the truth that our God is a God who judges sin" (p. 98). Supposedly, they are not making any claims about the historical extent of the Flood. But this is dubious, especially when it comes to the Apostle Peter's second epistle. In chapter 2, Peter discusses a chronological series of God's judgments: the pre-Flood angels, the Flood, and Sodom and Gomorrah (2 Peter 2:4–8). Here, Peter treats the Flood as an event of history, just like these others. All three serve as examples for people today precisely because God really did execute these judgments in history. So, when Peter says that God "did not spare the ancient world" (2 Peter 2:5), he is not implicitly thinking, "as the story goes". He means to say that God actually destroyed the ancient world.

But was he thinking of the 'world' in a restricted sense—referring to only part of the earth? No. In the very next chapter, Peter brings up the Flood again. There, he sets up a contrast between the pre-Flood "world that then existed" which was destroyed by water, and "the heavens and earth that now exist" which will be judged by fire (2 Peter 3:6–7). Clearly, the present heavens and earth is universal. But then the comparison indicates that the extent of the pre-Flood world, which "was deluged with water and perished", is also universal. Peter plainly thought the Flood engulfed the entire world, not just a part of it. Sadly, however, Longman and Walton never even mention this passage, let alone offer a response.

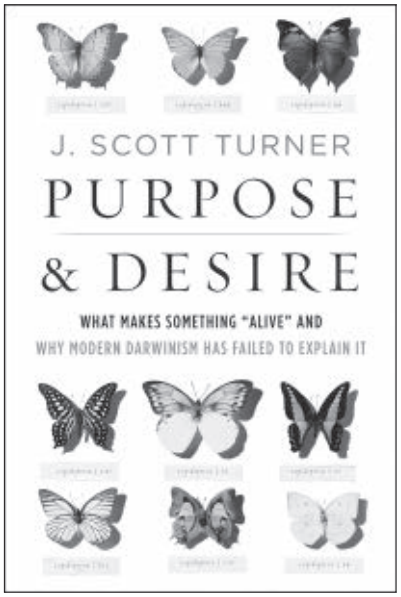
Conclusion

Walton's 'Lost World' books offer such a radical rethink of the biblical text that one wonders how the church could have gotten it so wrong for so long. But, when the arguments are evaluated and considered in light of Scripture, it turns out it is not the church that is wrong. Longman and Walton may be clever scholars who offer some helpful insights but, in the end, their reinterpretation of Noah's Flood doesn't hold water.

References

1. Statham, D., Dubious and dangerous exposition: a review of *The Lost World of Genesis One* by John H. Walton, *J. Creation* **24**(3):24–26, 2010; creation.com/genlostworld.
2. Halley, K., John Walton reimagines Adam and Eve: a review of *The Lost World of Adam and Eve* by John H. Walton, *J. Creation* **29**(2):47–51, 2015; creation.com/walton.
3. I will say, though, that in Moshier's chapter on the geological evidence, his straw men don't inspire confidence. He wrongly assumes the Flood water had to cover Mt Ararat at its present height, and that Noah landed in the same place he lived before the Flood (p. 153).
4. Confusingly, Longman and Walton seem to contradict themselves when they say the biblical text is "vague about human survivors" (p. 71). I take them to mean that the text is vague about the reality, though clear in the hyperbolic presentation that none survived.
5. Sarfati, J., Genesis: Bible authors believed it to be history, *Creation* **28**(2):21–23, March 2006.
6. bible-researcher.com/chicago1.html
7. Longman and Walton say the Ark's "dimensions are impractical" (p. 75) and are given to emphasize its importance, not its "actual size" (p. 76). They claim that seaworthy wooden boats have never been and cannot be built so large (pp. 39–40). However, they have not done their homework on wooden ships of antiquity. See Pierce, L., The large ships of antiquity, *Creation* **22**(3):46–48, June 2000, and Nunn, W., Amazing ancient Chinese treasure ships, *Creation* **37**(1):12–13, January 2015.

An unconventional evolutionist validates the irreducible complexity of living things



Purpose & Desire: What makes something 'alive' and why modern Darwinism has failed to explain it

J. Scott Turner

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John Woodmorappe

Dr J. Scott Turner is a biologist (physiologist) and Professor of Biology at the State University of New York College of Environmental Science and Forestry in Syracuse, New York. He has published numerous books, and he has been featured in a variety of science programs.

Turner identifies himself as an enthusiastic Darwinist (pp. 6–7). He also professes to be a Christian though, in his own words, "not a very good one" (p. x).

Though unambiguously an evolutionist, Turner contends that existing concepts of organic evolution are excessively reductionistic, and inadequate as they stand. The author speculates that, just as individual organisms have an internal homeostasis, so also does nature as a whole, and that is what is ultimately supposed to drive evolutionary change. Turner's views can be summarized by the following statements:

> "For nearly a century, our choice has been stark: the purposeless world of the materialist, or the demon-haunted world of the vitalist. For nearly a century, we have been forced to choose, and casting your lot with one has meant being cast out from the other. But there is a middle path to follow, which I have argued in this book means coming to grips with life's truly distinctive nature—its purposefulness, its intentionality, and its distinctive intelligence. Failing to do this will only cast us deeper into the shadows of irrelevance" (p. 298).

I do not find the author's ideas, on purpose-driven evolution, either particularly lucid or convincing. However, in voicing his ideas, Turner explicitly endorses many of the considerations raised by scientific creationists and by proponents of Intelligent Design (ID). That is the focus of this review.

Inadequacy of evolutionistic origin-of-life hypotheses

Decades ago, creationist biochemist Duane T. Gish had pointed out that any 'chemical soup' model suffers from a number of fatal defects, not the least of which is the fact that there would be an astonishing variety of chemical species in any mix, and hence any ultimately 'relevant' chemical species would be diluted into insignificance.

Using rather picturesque language, J. Scott Turner reaffirms this sobering fact. He comments:

> "Worse, the more we have learned, the more daunting the problems have become. First, there is the problem of yield. What cooks up in a Miller–Urey flask is a diverse stew of organic molecules, most of which are uninteresting, with the interesting bits invariably present in quite small quantities. Imagine wanting to find a particular type of screw in a warehouse of brads, nails, nuts, clips, and a zillion other fasteners, all jumbled together in a mountain of little scraps of randomly shaped metal. How can you argue that a screw is in there at all—or in the warehouse of the primordial soup, how something lifelike could come from that? The answer is, 'Not very plausibly'" (p. 233).

Dr Gish had focused on the synthesis of prebiotic proteins. Since there are 22 amino acids in existence, there are 22 different possibilities for the first position in the protein, times 22 different possibilities for the second position, times 22 different possibilities for the third position, etc. For even a medium-sized protein, there are more different possibilities than all the atoms in the known universe. Turner alludes to the implications of the consideration raised by Gish, "When you have enormous numbers of the precursors jumbling around, there is a finite chance that just the right sequence of events will occur; but the more interesting

the desired product is, the smaller the chances of it arising spontaneously" (p. 233).

Clay-crystal magic to the rescue?

Author Turner tries to get around the problem of the origin of life by dusting off the clay-crystal hypothesis for the origin of life, advocated by Scottish chemist A. Graham Cairns-Smith (1931–2016). Clay minerals, like all minerals, serve as templates for the growth of like-shaped minerals. Thus, in a sense, clay crystals can already naturally 'reproduce' by virtue of being crystals. They supposedly could be subjected to 'natural selection' based on their catalytic capability (that is, their presumed ability to 'devour' less-catalytic crystals, thereby driving the latter to extinction). According to the scenario—and I stress the word scenario—these super-catalytic crystals could successively grow more complex as a result of continued natural selection. Finally—lo and behold—a living thing would emerge. What's more, the carbon that is part of this primitive carbon-silicate life would literally take on a life of its own. That is, it would 'kick away' the silicate scaffold, and so we would be left only with the kind of all-carbon-based life with which we are familiar. He admits: "It's a crazy idea, but as is sometimes said, it may be just crazy enough to be true" (p. 240). But so can little green men on Mars. Turner, like Cairns-Smith, was driven to this 'crazy idea' simply because all other chemical evolutionary scenarios are even more chemically preposterous.

Turner does not address a fundamental question. If clay crystals themselves naturally become the objects of natural selection according to their catalytic abilities, then why aren't our soils readily dominated by clay crystals that have fantastic catalytic capabilities?

'Laboratory-made life', if anything, supports special creation, not evolution

Although a committed evolutionist, Turner echoes creationists as he discusses the imagined as well as actual significance of Synthia, the first 'synthetic organism'. He quips:

> "The logic is familiar: if scientists can make life in the laboratory, this must prove that life could have originated from just the right chemistry, thereby proving that life needn't come from the hand of God. In our modern secular culture, this has sometimes emboldened the nonbeliever to smite the creationist, and with unseemly glee. The biblical injunction to be mindful of the plank in one's own eye (Matt. 7:3–5) is germane here, for Synthia presents an uncomfortable paradox for our atheist friends to contemplate. We might call it the 'hands-of-the-scientist-god' paradox. Synthia carried a price tag of about $40 million. This money supported the numerous scientists, managers, and technicians involved, along with the highly sophisticated machinery and organizational infrastructure they needed to do their work. In short, Synthia was the collective product of the intelligence, foresight, and drive of everyone who worked to bring her into being. *The paradox is that none of this even slightly undermines the creationist argument for the origin of life; it strengthens it* [emphasis added]" (p. 227).

As if to rub-it-in to the evolutionist scoffer, Turner continues:

> "Actual life did not need the JCVI [J. Craig Venter Institute] to come into being, after all, nor any of its scientists, not any of its sophisticated machines, nor any of its already-existing microbial helpers: it came about entirely on its own. How did *that* happen? If Craig Venter needed a platoon of the smartest people in the world to cobble together a poor imitation of life, just imagine the intelligent force that had to have brought the original into being! [emphasis in original]" (p. 227).

Confessed irreducible complexity: DNA requires proteins, and proteins require DNA

Turner comments:

"Metabolism, to be more than mere chemistry, must be highly ordered, reliable, and reproducible. Bringing this orderliness reliably into being requires a high degree of specification, which must somehow be

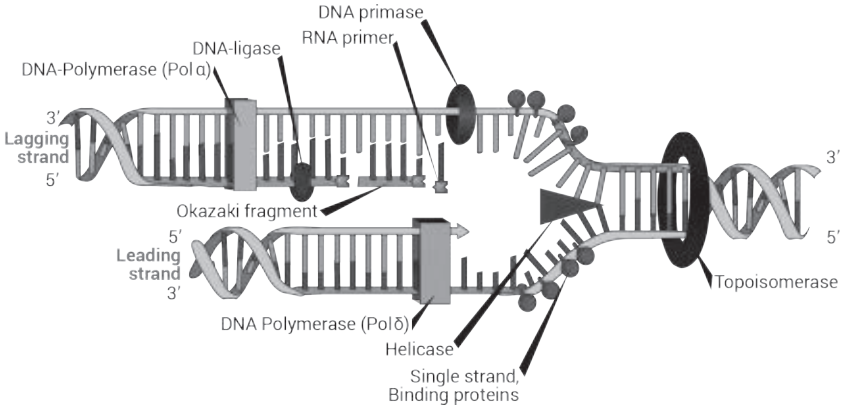

Figure 1. Accidental differences in the DNA molecules are supposed to cause evolutionary differentiation. But how did DNA originate in the first place? And which came first, the DNA that specifies protein sequence, or the protein sequence that is necessary to synthesize the DNA?

inherent in any presumptive living system. Currently we think this specification inheres in replicators, in specific sequence codes of nucleotides in DNA that speicify sequences of amino acids in proteins. So far, so good, but when we ask from where the replicators themselves come, things begin to loop around on themselves. The replicability that underlies DNA's status as a repository of hereditary memory depends upon a host of metabolic processes specified by particular protein catalysts. Those protein catalysts would not exist, of course, without the replicable hereditary memory … . The dilemma is obvious: each of the two necessary attributes of current life—heredity and metabolism—must exist for the other to exist. It is impossible (deluded, actually) to imagine such an intertwined system coming together all at once, with no intelligence guiding it. Yet if we are to believe that original life was anything like current life, we must believe they somehow did precisely that. To use a loaded phrase, present life seems to be 'irreducibly complex'" (pp. 229–230; see figure 1).

Evolutionistic hostility to any hint of teleology

Conventional evolutionistic thinking is not merely hostile to God: It is averse to *any* idea that deviates from strict materialism and chance. Turner makes this very clear: "It is a different story altogether when it comes to the problem of evolutionary adaptation. Speak of purpose and desire for evolutionary adaptation and you'll quickly be lumped in with the God-botherers and other intellectually malodorous tribes" (p. 71).

The author adds: "Modern evolutionism rejects this solution, not because it has been disproved, but because it is philosophically inconvenient" (p. 72).

Litigation and thought control: evolutionistic near-hysteria (the author's term) about Intelligent Design (ID)

Turner continues to take his fellow evolutionists to task, in no uncertain terms, as he comments:

"Exhibit A on this score is the near-hysteria that recently gripped evolutionists worldwide over Intelligent Design theory (IDT). Looked at objectively, IDT is a rather harmless and benign resurgence of Neoplatonism. Yet it was commonly represented in the scientific 'community' as something akin to the Golden Horde storming the Gates of Vienna, with all the illiberal responses one expects in a community that perceives itself under siege. The controversy was more or less suppressed with a federal judge's 2005 ruling in Kitzmiller v. Dover that IDT is not science and therefore was proscribed from being taught in science classrooms. The irony of 'academic freedom' seeking protection behind a federal judge defining what science is was lost in the victorious celebrations that followed the ruling" (p. 262).

There are further implications to all of this. Many people, including well-meaning Christians, have suggested that means other than persuasion (e.g. litigation) should not be attempted to try to 'force' creationism or ID into the classroom. Ironically, as Turner shows above, this consideration works both ways. Evolutionists have certainly been using means other than persuasion (e.g. litigation) to define-away ID as 'unscientific' and thereby to censor its presence in the classroom. (In the USA, the so-called American Civil Liberties Union watches, like a hawk, any hint of Christian expression in the public school system, and instantly threatens litigation.)

Natural selection is a tautology

Many different authors have identified 'natural selection' as a tautology. It is an empty concept that effectively speaks of 'the survival of the survivors'. In addition, 'natural selection', at least in the Darwinian sense, confuses the 'survival of the fittest' (an obvious truism) with the *arrival* of the fittest (a speculative evolutionary inference).

Here is how Turner analyzes it:

"The problem: our current conception of this core evolutionary idea is essentially meaningless. What is adaptation? The product of natural selection! What is natural selection? The outcome of adaptation … the conclusion is a restatement of the premise, for example, 'it is what it is'" (p. 8).

The concept of exaptation is a multiplied form of evolutionary tautology

The author discusses various evolutionary speculations on how avian flight is supposed to have evolved. According to one of them, feathers originally evolved so that the bird would have better heat balance. At some point, evolutionary processes co-opted the feathers for flight. According to some other ideas, feathers originally appeared in order to make the bird seem larger or more formidable.

Turner points out the fatal problem with this kind of thinking:

"If you think that this all sounds like special pleading and scenario spinning, you would be correct. For one thing, the concept of exaptation suffers from the same tautology that afflicts modern Darwinism. Where evolutionary adaptation is selection of genes that promote adaptation,

exaptation is an adaptation that leads to another adaptation—it's the same logical fallacy, multiplied" (p. 288).

The giraffe's long neck: Darwin to the rescue?

The author suggests that textbook orthodoxy is wrong, in which Lamarck was some kind of a dunce who believed that giraffes got long necks by stretching them for many generations, and Darwin was the brilliant scientist who figured out differential survival: that giraffes have long necks because short-necked giraffes could not compete, and so became extinct. Turner quips:

> "The familiar example of the giraffe just-so story should look familiar because it can be found in nearly every biology textbook written since. Usually, the giraffe story is filed under Lamarckism, but in all fairness it should be filed under Darwinism, for Darwin's theory of pangenesis was a Lamarckian scheme for the heritability of acquired characteristics across generations" (p. 94).

Kin selection and inclusive fitness

According to conventional evolutionary theories today, genes are selfish. The behaviours of living things are therefore driven to perpetuate the bearer's genes. That is why living things strive to survive, including at the expense of others. But how to account for altruistic behaviour in nature? The conventional explanation is that it is the gene that is selfish, and the ultimate object of natural selection, and not necessarily the individual. For instance, the worker bee sacrifices her own life by stinging an actual or potential intruder. However, according to conventional evolutionary explanation, this altruism is only apparent, because, in doing so, the worker's self-sacrifice indirectly enhances the survivorship of her own genes by enhancing the survivorship of the queen, which, after all, bears the same genes. Thus, the 'altruistic' character of the worker bee's suicidal behaviour is illusory. As Turner puts it, "altruism was in fact a surreptitious form of genetic selfishness …" (p. 196).

This textbook orthodoxy all sounds convincing, until examined closely. Turner shows that the queen bee is quite promiscuous, including with drones of other colonies, and that other social insects (e.g. termites) also have quite fluid mating and social systems (e.g. p. 205). Consequently, the colony and its specific genes can no more be the unit of natural selection than the individual and its genes. In other words, when the worker bee sacrifices herself for the benefit of the queen or colony, there is no guarantee that she is enhancing the survivorship of her own genes by enhancing the survivorship of the queen's genes, as the latter may be different.

The concept of ecological niche was pre-Darwinian, and was belatedly co-opted by evolutionists

J. Scott Turner comments:

> "The ecological niche is a venerable idea that predates the neo-Darwinian synthesis … . As it was originally conceived, the niche concept was reminiscent of William Paley's well-ordered creation—every species in its place, together producing a harmoniously functioning ecosystem" (p. 267).

And then evolutionary theory 'hijacked' the ecological niche. Turner continues:

> "Like nearly everything else biological in the early twentieth century, the neo-Darwinian revolution dramatically transformed this idea of the well-ordered niche. No longer was the niche an expression of a creature's proper place in nature: it became a site of contention and competition, tied up in nature's tragic drama, red in tooth and claw" (p. 267).

Today, evolutionists often say, with no small amount of intellectual arrogance, that "nothing in biology makes sense except in the light of evolution" and that creationism and ID have nothing to offer in terms of the advancement of our understanding of nature. The facts are exactly the opposite. Not only have many modern biological concepts (to which we can add the ecological niche to the list) originated before and without Darwinism, but had originally, at least in part, been creationist concepts.

Conclusions

There is a growing body of evolutionary scientists who, without endorsing either creationism or Intelligent Design, recognize that their ideas have at least some validity, and that standard evolutionary theory is fundamentally defective. It is high time that these well-aimed criticisms of standard evolutionary theory be recognized and respected in academia.

Long-distance boulder deposits

I commend Mr Oard for his article, *Long-distance boulder deposits reveal Noah's Flood*,[1] tackling this interesting question in geomorphology. This *Creation* article summarizes a number of papers published in *Journal of Creation* on this topic.[2] I question whether "Flood runoff seems to be the only way to account for these observations" is the only answer or even the best. All quotes below, unless otherwise indicated, will be from Oard's *Creation* article.

> "The floodwaters rushing off the land into the oceans, initiated by the mountains rising and ocean basins sinking, would have eroded massive amounts of rock from the continents. This flowing water would have transported the material for long distances, pulverizing the softer rocks and rounding the harder ones."

I will take this statement as a summary of his Flood model.

Psalm 104:8 clearly says, "The mountains rose and valleys sank." Not 'the continents rose and the oceans sank'. I don't believe any Hebrew scholar would support the conflated idea that mountains and valleys could be equated with larger continental landmasses and entire ocean basins.

"As the Rockies, running roughly north-south, uplifted, floodwater eroded hard quartzite rock from these mountains and spread it far away to the west and east." I think he is mixing actualistic thinking with his Flood model. Only the actualistic or uniformitarian models postulate flow in both directions from a slowly emerging mountain uplift, but today's flow off of these mountains, as he mentions, is not adequate to carry and distribute the quartzite to these locations, so the uniformitarian model fails. Only the catastrophic flow of the Flood is adequate. But, if that flow was initiated by continents rising and ocean basins sinking, why would it have been divided into two directions? If the rising Rockies divided that flow, wouldn't they also have divided the flow strength, and would that have been adequate? Seems reasonable to suggest it would not.

The transport direction to the west was the shortest (640 km) and, therefore, the weakest direction. Although, the west would be the direction of the Coriolis Effect at the mid latitudes, which one Flood modeller[3] suggested would have been the primary direction of current. Flow to the east while less predicted, is evidenced by Oard's cited statistics to be the strongest, transporting the greatest distance (1,000 km). Also, is he going to model the rise of the Appalachian Mountains at this same time? The flow off of them would directly oppose this flow off of the Rockies, decreasing its carrying power. Remember, we are modelling Flood runoff, so it would be far wider and deeper than any present river's flow.

Oard postulates that the topography of the eventual deposition places for the quartzite boulders had to be deep ravines (eastern Idaho) and high mountains (Rim Gravel of Arizona) already in those positions when the quartzite boulders were distributed. Either the topography already had to be in place or this model requires multiple risings. And, if this is the case, which one rising and sinking was the drastic event the model requires?

The assumption that the source of the Rim Gravel had to erode "a few kilometres" suggests a drastic amount of erosion. The Actualistic modellers regularly assume such erosion because their model has no alternative, but that is a lot of erosion for a very short timeframe, and is it necessary?

"As the water carried the quartzite boulders along, they would have crashed together ferociously leaving percussion marks on their surface." Some rounded boulders do not have them. If percussion erosion was the primary means of eroding the round shape, then all the boulders should be covered with percussion marks. It is evident by their lack that rounding of the boulders was a process without percussion, and only short turbulent transport of some boulders to their final resting place produced percussion marks. This suggests the boulders were not water transported most of the distance from their origin to their final resting place.

The boulders pictured in the article have black, red, and white rinds/surfaces, and further research will find the same colouring of individual grains in the rock. Although all of these colours are found in quartzite boulders, the grain colour in the particular boulders is not always the same as their rind, and occasionally the colour of quartzite grains will abruptly change in a single boulder at a line that mimics sedimentary layering. A clue to their origin may reside in these colour differences. All of them reflect different forms of iron oxide, primarily produced by different temperatures and pressures. The quartzite may have formed as vapour condensate from impacts and settled to earth, solidifying as it cooled. Then they would have been fractured and thrown into the air as ejecta by a second impact. The descent both times would have caused the same iron in the quartzite to be coloured differently depending on where it was in the cloud when it cooled to its solid state. Black, yellow, and purple denote reduced iron (less or no oxygen available) and brown and red denote oxidized iron (abundant oxygen available). Boulders don't have percussion marks all over them because they were rounded by ablation, subliming of the quartz in the rough surface as they passed through superheated air on their return to earth. The surface retained extra iron, which coloured the rind.

To accomplish this, we need a Flood process that would raise mountains

and sink valleys (not erode them). Blasting molten material from the surface and mantle with sufficient heat and pressure to vaporize and condense rock, moving large quantities of rock 1,000 km away, would fill deep ravines and leave them on high mountains, ablating the rock surface as they fell, changing the colours as the iron oxide responded to local conditions. Multiple smaller events that produce these same conditions over a 500–600 km radius would be an alternative.

An impact model includes mountains rising with the expression of the shock wave, and an adjacent valley being formed by the release wave.[4] Maybe Psalm 104:8 is really a description of the effects of impacts on the earth?

Neither Oard's nor my model may be the best one, but any model must take all known evidence into account. Then the model used will directly determine how much erosion we expect (kilometres or metres) and the sequence of other geomorphic change that were operating.

W.R. Barnhart
Grover Beach, CA
UNITED STATES of AMERICA

References

1. Oard, M., Long-distance boulder deposits reveal Noah's Flood, *Creation* **38**(3):24–27, 2016; creation.com/noahs-flood-explains-boulder-deposits.
2. Oard, M., Hergenrather, J., and Klevberg, P., Flood transported quartzites east of the Rocky Mountains, *J. Creation* **19**(3):76–90, 2005. Oard, M.J., Hergenrather, J., and Klevberg, P., Flood transported quartzites: Part 2–west of the Rocky Mountains, *J. Creation* **20**(2):71–81, 2006; creation.com/ftq2. Oard, M.J., Hergenrather, J., and Klevberg, P., Flood transported quartzites: Part 3–failure of uniformitarian interpretations, *J. Creation* **20**(3):78–86, 2006; creation.com/ftq3. Oard, M.J., Hergenrather, J., and Klevberg, P., Flood transported quartzites: Part 4–diluvial interpretations, *J. Creation* **21**(1):86–91, 2007; creation.com/ftq4.
3. Baumgardner, J.R. and Barnette, D.W, Patterns of ocean circulation over the continents during Noah's Flood; in: Walsh, R.E. (Ed.), *Proceedings of the Third International Conference on Creationism*, Creation Science Fellowship, Pittsburgh, PA, pp. 77–86, 1994.
4. Barnhart, W.R., Cratering and the Earth: clues in lineaments, *CRSQ* **53**(3):191–205, 2017.

» Michael Oard replies:

Mr Barnhart questions whether Flood runoff is the only way, or even the best way, to transport quartzite rocks up to boulder size that became well-rounded. Yes, Psalm 104:8 refers to the mountains rising and the valleys sinking, which is a global phenomenon of the mid to late Cenozoic.[1,2] Since the runoff stage of the Flood was a global pattern, it is not too much of an extrapolation to suggest that there were also long wavelength vertical motions (continents rising and/or ocean basins sinking) at the same time as short wavelength oscillations. Geological evidence for differential vertical tectonics is well established and abundant.[2] The change in potential energy that would accompany this widespread tectonic activity would have caused the floodwater to rush off of the continents. Floodwater quickly draining from the continents explains the abundant evidence for massive amounts of continental erosion,[3–5] such as the average 2,500–5,000 m of erosion from the Colorado Plateau.[6]

During such erosion, it is reasonable that the softer rocks would be pulverized and the harder rocks would be transported for long distances—exactly as observed in the northwest United States and adjacent Canada and many other areas of the world.[2] There is nothing 'actualistic' about such a scenario when we consider the 221-day timescale of the Recessive Stage of the Flood.

In regard to whether the Rocky Mountains rising was capable of splitting the flow, once the mountains were exposed above the floodwater, the increasing potential energy due to differential vertical tectonics would rapidly accelerate the flows toward the east and west.

The Coriolis force is a force that causes a current to veer toward the right in the Northern Hemisphere. It would have been operant, but not a significant force compared to the widespread, active tectonics, volcanism, differential vertical tectonics, etc. concurrent in the Recessive Stage of the Flood.

I would speculate that the Appalachians rose a bit earlier than the Rocky Mountains, since they are more rounded and they display about 6 km of erosion.[2,7] But, eventually the rising Appalachians would have split the flow about midway during flood runoff. After this, a westward-moving current would have begun on the west side of the Appalachians. This current would of course not have been blocked but would have converged with the one moving toward the east away from the Rocky Mountains. The two currents would have converged, creating an accelerating flow toward the south in the United States Midwest. It would have picked up an enormous amount of sediment and deposited it in Texas, Mississippi, and the Gulf of Mexico (which is what we see).

The metaquartzite rocks (from now on referred to simply as 'quartzite') were deposited over a wide area in a variety of contexts: deep rifts, mountain tops, valleys, plateaus, the plains, on top of the Columbia River Basalt, and into Puget Sound and the San Juan Islands. There are probably trillions of these well-rounded quartzites, rounded by the action of water scattered across the northwest United States and adjacent Canada.

The Rim Gravels of Arizona are similar and different than the coarse gravels farther northwest.[2] Based on imbrication of the rocks, the Rim Gravels originated tens of kilometres to the south and southwest from terrain that is now much lower. Since the Rim Gravels are essentially a lag after huge erosion, and since water generally runs downhill (depending also upon the floodwater surface slope), it stands to reason that vast erosion took place in southern and central Arizona during the flood runoff.

Percussion marks must have formed in the fastest, most turbulent flows.

Since there must have been a variety of flow regimes, I do not expect all quartzite rocks to have percussion marks. I can say that percussion marks are common, and some cobbles and boulders have hundreds of them on a surface. Some quartzite deposits have few rocks with percussion marks, and in other deposits almost every rock has the marks. There is no indication they are formed by normal flood runoff.

Yes, there could be a clue in the colour of the quartzite rocks as to their source. Quartzite rocks have a wide variety of colours and textures and are often coated with an iron-oxide patina. The colours are due to more than varieties of iron; they reflect various minerals mixed in with the original quartz sand deposited, not burial temperature. Of course, the quartzite was at one time deeply buried, which is why it is a metamorphic rock. The quartzite layers rose along with the mountains. Each single quartzite cobble and boulder deposit has a variety of these colours, suggesting mixing of sources. So, it would be difficult to find any particular source based on colour.

The source of the well-rounded quartzite rocks is mainly the western Rocky Mountains, where thick sheets of it are found mixed with argillite (a metamorphic shale) in the widespread, very thick Belt Supergroup. There are small areas of quartzite in the eastern Rocky Mountains and the Little and Big Belt Mountains of central Montana that probably contributed a small number of well-rounded quartzite rocks.

Barnhart needs to have scientific proof that quartzites can be condensates formed by an impact; otherwise Flood runoff provides a reasonable and straightforward explanation for the spread of the quartzite rocks.

Michael J. Oard
Bozeman, MT
UNITED STATES of AMERICA

References

1. King, L.C., *Wandering Continents and Spreading Sea Floors on an Expanding Earth*, John Wiley and Sons, New York, 1983.
2. Oard, M.J., *Earth's Surface Shaped by Genesis Flood Runoff*, 2013, (ebook), michael.oards.net/GenesisFloodRunoff.htm.
3. Oard, M.J., Surficial continental erosion places the Flood/post-Flood boundary in the late Cenozoic, *J. Creation* **27**(2):62–70, 2013.
4. Oard, M.J., Tremendous erosion of continents during the Recessive Stage of the Flood, *J. Creation* **31**(3):74–81, 2017.
5. Oard, M.J., Massive erosion of continents demonstrates Flood runoff, *Creation* **35**(3):44–47, 2013.
6. Schmidt, K.-H., The significance of scarp retreat for Cenozoic landform evolution on the Colorado Plateau, US, *Earth Surface Processes and Landforms* **14**:93–105, 1989.
7. Oard, M.J., Origin of Appalachian geomorphology Part I: erosion by retreating floodwater and the formation of the continental margin, *CRSQ* **48**(1):33–48, 2011.

God's Word or Human Reason? —a reply to John Woodmorappe

In the August 2018 issue of the *Journal of Creation*, John Woodmorappe published a negative review[1] of my 2016 book *God's Word or Human Reason? An inside perspective on creationism*. Here I'll respond to a few of Woodmorappe's most important points.

Part of Woodmorappe's review concerns my discussion about fulfilled predictions made by creationism and by evolution. Woodmorappe points out that creationism's scorecard is not empty in this respect (and the book acknowledges this), but in this area he has overlooked my most important argument. Numerous advances in technology and bioscience have been based on the reliability of predictions made by evolutionary and old-earth models, and if YEC models were able to predict future observations just as reliably, they would have many real-life applications as well. One example discussed in the book is that if accelerated nuclear decay were possible under conditions that can occur naturally on Earth, this model could be used to develop more efficient forms of nuclear power. My point was that although scientists who are creationists have contributed to the development of many useful technologies, those sorts of real-life applications of creationist models *themselves* have not happened.

Woodmorappe appears to have misunderstood the book's most important example of an advance in bioscience resulting from evolution's predictions. This advance is the discovery of the genes, and the proteins they code for, that give chimpanzees their resistance to HIV (human immunodeficiency virus) and SIV (simian immunodeficiency virus). His

review offers an explanation for the fact that human cells were capable of functioning with the chimpanzee version of one of these genes, but that compatibility is *not* the prediction the book was discussing.

The prediction being discussed concerned *which* specific genes give chimpanzees their resistance to these viruses. According to evolutionary models, humans and chimpanzees share a recent common ancestor, but this disease resistance exists only in chimpanzees and not in humans. Researchers concluded that therefore the trait must have evolved in chimpanzees after their ancestors diverged from ours, and so the genes coding for it in chimpanzees must have been heavily modified by natural selection. By searching for chimpanzee genes that showed signs of heavy selection, these researchers identified three genes, known as ICAMs, that give chimpanzees their resistance to HIV and SIV.[2] The transplanting of one of the chimpanzee ICAMs into a culture of human cells is significant because it made the human cells resistant to HIV, demonstrating that the genes they had identified did indeed have this effect. The prediction that chimpanzees' genes for HIV/SIV resistance must show heavy selection was based on an evolutionary model, so when the genes were identified on the basis of that prediction, it was an example of this model producing a real-life benefit.

One other unfortunate characteristic of Woodmorappe's review is the seeming rejection of some ideas that are well established among creation scientists. For example, his review states: "I already knew that the geologic column did not exist, and this is not changed by the fact that 1% of Earth's land surface has representatives of all 10 Phanerozoic geologic systems in place." However, a variety of diluvial geology sources have accepted that the geologic column does, in fact, exist.[3–6] Quoting Johns (2016): "Most YECs with training in geology accept the reality of the geological column."[7] This is one example of the book's concepts being taken more seriously among YECs than Woodmorappe gives them credit for.

As a second example, many of the specific points made by the chapter about the origin of birds[8] were also brought up in Matthew McLain *et al.*'s study[9] that was presented at the *Eighth International Conference on Creationism*. Points mentioned in both this chapter and McLain's study include the lack of a clear anatomical boundary between theropod dinosaurs and birds, creationists' history of uncertainty about which of those two groups *Archaeopteryx* should be placed in, and William Beebe's prediction of the existence of four-winged feathered reptiles more than 80 years before fossils of these animals were discovered. McLain *et al.* cite the book for one of their points, suggesting that in this area, it has contributed something of value to creationist discourse.

McLain's study, along with the 2013 study by Garner *et al.*[10] that it builds upon, represents a new direction for creationist scholarship about dinosaurs and birds. Instead of simply attacking the evolutionary model of bird origins, these studies have worked to develop a consistent set of alternative models to explain the fossil data within a creationist worldview. The pursuit of this goal requires acknowledging the data that needs to be explained, such as the existence of pennaceous feathers on some fossils of dinosaurs (as discussed by Garner's study). In the past, the major YEC organizations' discussions of these animals often have lacked a consistent set of criteria to classify them.[11] If creationists wish to develop a functioning set of models in this area, they will need to adopt the new approach taken by Garner and McLain.

I do not expect any of the regular contributors to this journal to agree with me about evolution, but I hope that McLain's arguments and my own can motivate them to improve their models and their arguments. In 2002, Wieland *et al.* wrote:

> "… we think that Christians should be very much concerned about whether Biblical creation is being defended using arguments that are, for instance, factually incorrect, logically invalid, based on an incorrect understanding of the scientific evidence, etc. These sorts of things ... actually end up harming the cause of biblical creation (and hence, by extension, the Bible itself)."[12]

In the quoted article, Wieland *et al.* were arguing that it is important for creationist models to be critiqued by fellow creationists, but creationists are not the only people capable of offering valid criticism of these models. It would be valuable if more creation scientists were willing to consider criticism of their models from individuals outside of their academic community.

Jonathan Kane
Flat Rock, NC
UNITED STATED of AMERICA

References

1. Woodmorappe, J., A detailed rehash of all the canned anti-creationist shibboleths: a review of *God's Word or Human Reason? An inside perspective on creationism* (Jonathan Kane, Emily Willoughby, and T. Michael Keesey), *J. Creation* **32**(2):42–47, 2018.
2. Walter, N., Stebbing, J., and Messier, W., The potential significance of adaptive evolution and dimerization in chimpanzee intercellular cell adhesion molecules (ICAMs), *J. Theoretical Biology* **232**:339–346, 2005.
3. Snelling, A., Ernst, M., Scheven, E., Scheven, J., Austin, S., Wise, K., Garner, P., Garton, M., and Tyler, D., The geological record, *J. Creation* **10**(3):333–334, 1996.
4. Robinson, S., The geological column: a concept fundamental to Flood geology, *Origins* **23**:14–30, 1997.
5. Tyler, D. and Coffin, H., Accept the column, reject the chronology; in: Reed, J. and Oard, M. (Eds.), *The Geologic Column: Perspectives within diluvial geology*, Creation Research Society Books, Chino Valley, AZ, pp. 53–69, 2006.
6. Snelling, A., Paleontological issues: deciphering the fossil record of the Flood and its aftermath; in: Boyd, S. and Snelling, A. (Eds.), *Grappling with the Chronology of the Genesis Flood*, Master Books, Green Forest, AR, pp. 145–185, 2014.
7. Johns, W., Scriptural geology, then and now, *Answers Research J.* **9**:317–337, 2016.

8. Kane, J., Created kinds and the origin of birds; in: Kane, J., Willoughby, E., Keesey, T., Morton, G., and Comer, J., *God's Word or Human Reason? An inside perspective on creationism*, Inkwater Press, Tigard, OR, pp. 105–180, 2016.
9. McLain, M., Petrone, M., and Speights, M., Feathered dinosaurs reconsidered: new insights from baraminology and ethnotaxonomy; in: Whitmore, J. (Ed.), *Proceedings of the Eighth International Conference on Creationism*, Creation Science Fellowship, Pittsburgh, PA, pp. 472–515, 2018.
10. Garner, P., Wood, T., and Ross, M., Baraminological analysis of Jurassic and Cretaceous Avialae; in: Horstemeyer, M. (Ed.), *Proceedings of the Seventh International Conference on Creationism*, Creation Science Fellowship, Pittsburgh, PA, 2013.
11. Kane, J., Creationist classification of theropods, 8 November 2016, pandasthumb.org/archives/2016/11/creationist-class.html, accessed 9 August 2018.
12. Wieland, C., Ham, K., and Sarfati, J., Maintaining creationist integrity: a response to Kent Hovind, October 2002, creation.com/maintaining-creationist-integrity-response-to-kent-hovind, accessed 9 August 2018.

» John Woodmorappe replies:

Jonathan Kane has put together three disparate topics, and I respond accordingly.

Orthologous genes—a variant of the old argument from homology

The fact that a chimp gene finds structural and functional correspondence to a human gene, and can function in a human setting, is not proof of evolution. By analogy, the engine in one car is 'orthologous' to the engine in another car, but this is not evidence that they both evolved from a common ancestor with the same kind of engine. Nor is it a prediction of evolutionary theory. It is hardly surprising that the engine from one car can be substituted for the engine of another, similar car, and perform its function.

Bird evolution—the real issues

I am quite familiar with such things as the various opinions as to what divides a dinosaur from a bird, and which (if any) dinosaurs had real feathers. (I attended the ICC presentations.) However, none of this is relevant to the central fact that the presumed dinosaur-to-bird phylogenetic chain consists of a series of disparate, specialized, inconsistently progressing, cobbled-together fossil organisms.[1]

The geologic column yet again

Kane repeats the quote: "Most YECs with training in geology accept the reality of the geological column." How does he know that? Was there ever a survey of all creationist geologists on this topic? (Note that the geologic-column-affirmers are the ones that tend to get all the attention). In any case, even if it is true, it is an exercise in logical fallacies, for example *ad populam*. In science, especially, truth is not synonymous with majority opinion!

No informed person doubts that lithologies can, in a general sense, be correlated by fossils all over the world. However this, by itself, is not the geologic column. The geologic column, apart from the special pleading in its very design,[2] is based, among other things, on the uniformitarian assumption that distinctive fossils have time significance.[3] This assumption has no warrant outside of uniformitarianism, and so the standard geologic column, in and of itself, has no place in Flood geology. Thus, for example, there is no basis for supposing that a Cambrian rock in one part of the world was necessarily laid down at the same time as a Cambrian rock elsewhere in the world. Nor is there any basis (except when dictated by local superposition) for supposing that a Cambrian rock in one part of the world was necessarily deposited before a Devonian rock somewhere else in the world.

Unfortunately, far too many creationists have ignored this basic fact, and have tried to 'import' the geologic column into Flood geology, as is, by 'speeding it up' from 600 million years to a few decades or centuries. This, among other things, has led to endless and fruitless speculation as to which part of the geologic column corresponds to which stage of the Flood. It has also led to neo-Cuvierism—the notion that parts of the geologic column took 'too long' to have possibly formed during the Flood. Neo-Cuvierism, in turn, leads to the *reductio ad absurdum* of the entire Phanerozoic sedimentary record becoming post-Flood, with the Flood itself disappearing to somewhere far down in the Proterozoic or Archean. More likely, the Flood disappears entirely, and we are back to full-blown uniformitarianism. That is what happened, for example, to Glenn Morton.

Fortunately, creationist geologists are finally starting to break out of the shackles of uniformitarianism, though—in my opinion—not nearly enough. The discussions about the Flood/post-Flood boundary, held at the Eighth International Creation Conference in Pittsburg (August 2018), which I attended, bear this out. There is increasing realization that no stage of the Flood necessarily corresponds to some particular global interval of the Phanerozoic geologic column (for example, a Flood end at the Cretaceous-Tertiary boundary). It is also encouraging to see a return of the common-sense parsimonious Morris-Whitcomb understanding of the Flood, in which only Miocene, Pliocene, and Pleistocene are potentially post-Flood.

John Woodmorappe
Chicago, IL
UNITED STATED of AMERICA

References

1. Woodmorappe, J., Bird evolution: discontinuities and reversals, *J. Creation* **17**(1):88–94, 2003.
2. Woodmorappe, J., Studies in Flood geology: clarifications related to the 'reality' of the geologic column, *J. Creation* **10**(2):279–290, 1996.
3. Woodmorappe, J., The geologic column: does it exist? *J. Creation* **13**(2):77–82, 1999.

Answer to a persistent critic of RATE helium research

D. Russell Humphreys

Editor's note: Recently Steve McRae, the owner of a website[1] called "The Great Debate Community", asked Dr Russell Humphreys to respond to recent critiques (of Humphreys' research) by Dr Kevin Henke and Dr Gary Loechelt[2] on McRae's site. Most of the people posting on the website are not Christians and are strongly opposed to young-earth creationism. A few old-earth Christians, such as Loechelt and Dr Hugh Ross, occasionally post on the website also, criticizing the idea of a young world. Here is Humphreys' response, which McRae posted on 7 July 2018.

Critics of my part of the Radioisotopes and the Age of the Earth (RATE) research initiative[3] have been numerous ever since the project published a technical book[4] in 2005 containing the results of our field and laboratory research. The critics don't like the results of my project. I found evidence that tiny radioactive zircon crystals (figure 1) in granitic rock several miles deep in a borehole in New Mexico are only about 6,000 (± 2,000) years old, in contrast to the 1.5 Ga worth (assuming today's rate) of uranium-to-lead decay the zircons have undergone. The evidence is the remarkably high percentage of helium from uranium decay that the crystals have retained, combined with measurements by an expert showing that helium leaks out of these crystals rather rapidly. Exhaustive details are in my chapter of the RATE results book.[5]

Figure 2 shows the evidence. The vertical axis, 'Diffusivity', gives the rate of leakage of helium out of the crystals. Notice that the vertical scale is very compressed ('logarithmic'), covering a trillion-fold range of numbers. The horizontal axis is the temperature of the crystals in the borehole and then in the lab. To help non-experts, I've shown the temperature increasing from left to right, rather than the other way around (as in figures 5 and 6 below). The dots show the helium leak rates that Ken Farley measured from these zircons. Dr Farley, at Cal Tech, is a world-class expert on helium diffusion (spreading in, leakage from)

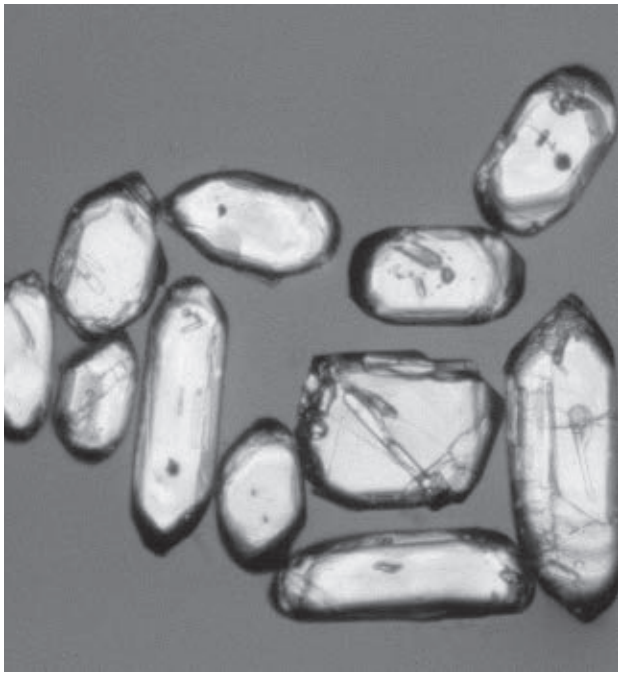

Photo by R.V. Gentry

Figure 1. Microscopic zircons used in this research

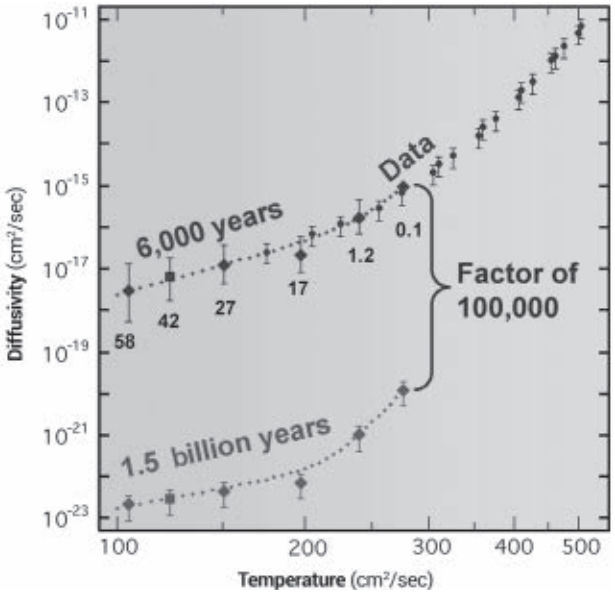

Figure 2. Predicted (diamonds) and measured (dots) helium leak rates ('diffusivity') of zircons. The data fit the 6,000-year prediction very well. Note that temperature increases from left to right, in contrast to figures 5 and 6 below.

in geologic minerals. The black numbers, '58', '42', etc., are the percentages of helium now retained in the zircons as compared to the amount of helium that 1.5 Ga worth of uranium-to-lead decay deposited in them initially. The diamonds labelled '6,000 years' are the diffusivities I predicted[6] the zircons would be shown to have if they were indeed six millennia old. The data (the dots), taken three years later, confirm the prediction remarkably well. On the other hand, the data are between 100,000 times to a million times higher than the low diffusivities labelled '1.5 Billion years' (diamonds) that would be required for the zircons to retain the measured percentages after that much time.

In other words, a straightforward understanding of the experimental data says the zircons are far too leaky to retain their helium longer than thousands of years, certainly not for millions of years or more.

A short non-technical internet article of mine discusses the above things in more detail and then discusses all the critics of the helium project up to November 2008.[7] Those include Dr Kevin Henke and Dr Gary Loechelt, who recently made PowerPoint presentations on this site. Upon my request (so I could decide if I wanted to spend time listening to them), both of them sent me (via Steve McRae) some brief outlines of what they said. Kevin Henke had nothing new that I could see, and he himself advised me to concentrate on what Gary Loechelt had to say. So that is what I'll do here. If you don't have the time for a detailed discussion, please at least see the epilogue at the end. It explains why this issue is important.

Loechelt's case in a nutshell

In my opinion, the most significant point in Loechelt's presentation is encapsulated in table 1 (my caption) from one of his slides:

Table 1. Parameters (E_a and D_0) of straight-line fits to parts of helium diffusion data, and diffusivities (D) at 180°C and 87°C implied by the parameters (from Loechelt, ref. 2; boxes added by Humphreys)

Comparison of published helium diffusion activation energies (E_a) and pre-factors (D_0) to the results from the RATE experiment.

E_a (kCal/mol)	D_0 (cm^2/s)	D (T = 180°C) (cm^2/s)	D (T = 87°C) (cm^2/s)	Reference
13.9	1.7E-10	3.1E-17	5.7E-19	Humphreys 2004 (low temperature data)
38.1	3.1E-01	1.3E-19	2.3E-24	Humphreys 2004 (high temperature data)
40.4	4.6E-01	1.5E-20	1.4E-25	Reiners 2004
34.9	2.3E-03	3.4E-20	1.5E-24	Cherniak 2009 (perpendicular direction)
35.4	1.7E-01	1.5E-18	5.8E-23	Cherniak 2009 (parallel direction)
38.2	3.0E-02	1.1E-20	1.9E-25	Wolfe 2010
33.0	2.7E-02	3.2E-18	2.5E-22	Guenthner 2013 (Mud Tank, parallel)
39.7	2.3E-02	1.6E-21	1.8E-26	Guenthner 2013 (RB140, parallel)
38.9	2.7E-02	4.5E-21	6.4E-26	Guenthner 2013 (M127, parallel)

You might think that the numbers in the big box represent actual diffusion data measured by the experimenters at the temperatures indicated at the top of the column, 180°C and 87°C. But no, these are *synthetic* data points extrapolated down from high temperatures, about 300°C and higher. Except for the RATE experiments, none of the experimenters made any actual measurements at low temperatures, say from 200°C down to 100°C. The small box shows numbers made from a line drawn through Farley's measurements for low temperatures, and the numbers represent his results fairly accurately. The big point that Loechelt is trying to make is that the small-box numbers disagree with the big-box numbers so, he assumes, the small-box numbers must be wrong.

Why does he make that assumption? Why does he prefer synthetic numbers over the real ones? The big reason is that he believes the earth is old, so he wants to greatly reduce the low-temperature diffusivities in order that the zircons might retain their helium for 1.5 Ga. The solid line and stars in figure 3 show how he wants to revise the RATE data downward. Notice, however, that the solid line is still significantly higher than the '1.5 Ga' model … by a factor of 10 on the left up to a factor of nearly 100,000 on the right.

Figure 4 shows Loechelt's rationale, which was part of the same slide that had his table. Picking up the word 'anomalies' from the last line of figure 4, Loechelt is apparently applying it to Farley's low-temperature data, implying that they are somehow not legitimate. He thinks Fechtig and Kalbitzer[8] (hereafter abbreviated F&K) recommend that he ignore such measurements and that he should instead extrapolate down from the high-temperature measurements. Loechelt supplied me with five quotes from F&K which he thinks support what he says. But all of them appear to apply only to a special variety of 'non-volumic' diffusion, a variety which only

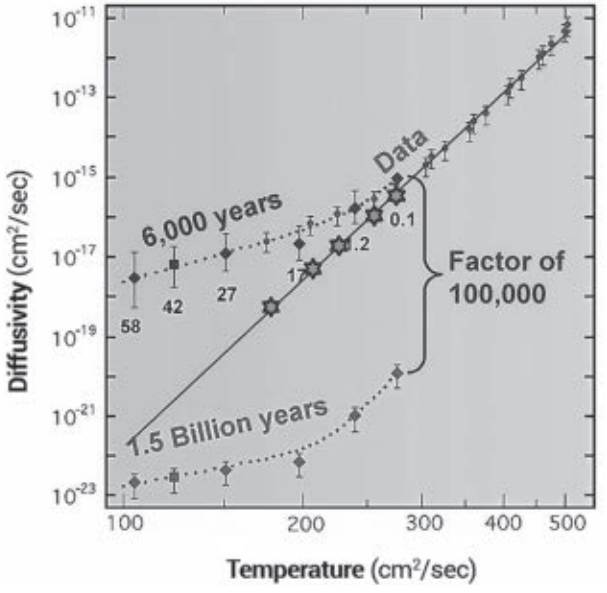

Figure 3. Extrapolated solid line and stars show how Loechelt wants to reduce the diffusivities measured by Farley.

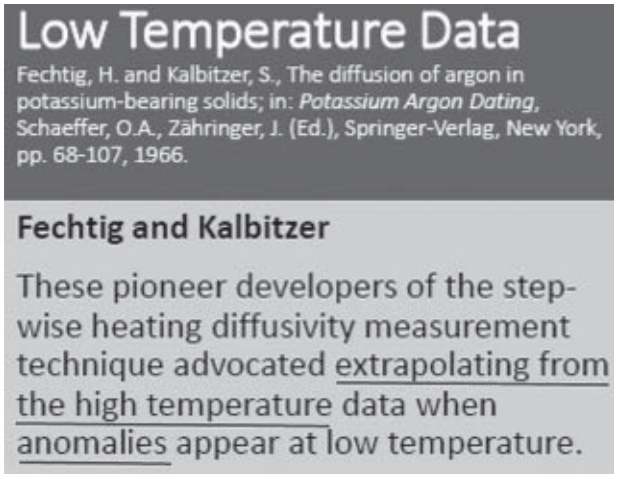

Figure 4. Loechelt's rationale for replacing data with an extrapolation (from Loechelt, ref. 2; underlining by Humphreys)

affects a very small percentage of the total helium in the crystal. I will discuss that case in the next section. Loechelt did not send me the F&K quote below; it says exactly the opposite of what he wants (highlighting mine):

> These results on this "simple" system show that the diffusion of argon at low temperatures should not be calculated from high-temperature measurements, but that measurements have to be performed in the low-temperature interval.
> —*Fechtig and Kalbitzer (1966), p. 84.*

This appears to be a general principle which would reasonably apply to any situation in which significant amounts of a noble gas diffuse out of a crystal differently at low temperatures than at high temperatures. I.e. the diffusion experts prefer measurements over extrapolations. The next section shows why Loechelt thought otherwise.

Confusion over 'non-volumic' diffusion

Non-volumic diffusion includes a special case I here call *surface* diffusion, meaning diffusion of *small* quantities of helium from *at or near the surface* of a crystal, including the surface of cracks in the crystal. This contrasts with volumic diffusion: large quantities of helium coming from within the entire body of the crystal. Noble gas at or near the surface is often "weakly bound" or "loosely bound," and so "will diffuse out easily," say F&K (p. 74). "This *exhaustible* small amount" (F&K, p. 82) of noble gas will normally be released in the earliest part of an experiment, when the experimenter increases the temperature in steps from a low temperature (say 100°C) up to a high temperature (say 500°C). When the experimenter then decreases the temperature in steps, the subsequent diffusion data will not follow the data from the first upward steps because the 'loose' gas has already left the crystal. Subsequent cycles up or down usually follow the data from the first downward steps. That means one can eliminate the surface diffusion data simply by ignoring the first set of upward steps. For a variety of reasons, Farley recommended that we ignore the data from those initial steps, and that is what we did. So the data we show do not include any surface diffusion. I'll give a specific example a few paragraphs below.

Unfortunately, F&K use a broader definition of non-volumic diffusion. It includes both surface diffusion and

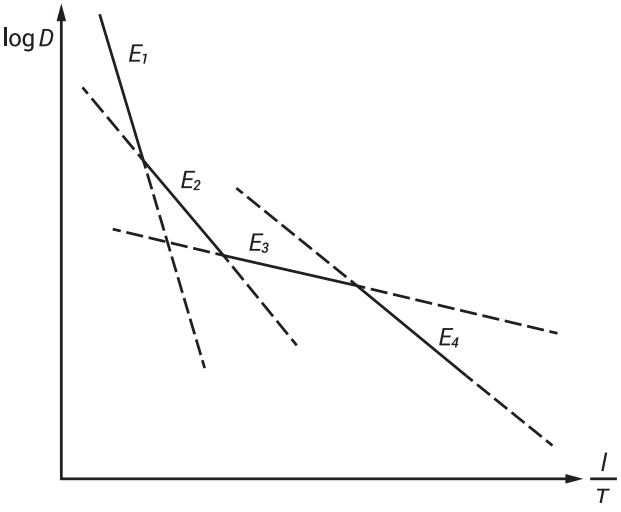

Figure 5. Logarithm of diffusivity D versus inverse (absolute) temperature T (from Fechtig and Kalbitzer, figure 13, p. 85). Math details in the next section. Steepest-slope component is labelled E_1, while E_2, E_3, and E_4 label components with lower slopes. Here, temperature increases from right to left. Figure 6, below, explains this type of graph more fully.

any other diffusion mechanism that gives a shallower slope in figure 5 than the slope of the main high-temperature component, the one with the label E_1. Most of the other shallow-slope components, besides surface diffusion (which also has a shallow slope), are from sources that are usually distributed uniformly throughout the whole volume of the crystal, such as lattice imperfections (point defects, grain boundaries, dislocations, etc.) and impurities, all of which are very common in naturally occurring minerals.[8, 9] These mechanisms draw upon *all* the helium in the volume, merely offering different pathways of diffusion. We might call this variety of non-volumic diffusion *inexhaustible* diffusion, 'inexhaustible' by comparison with the much more exhaustible surface diffusion.

This is the crucial problem I see with Loechelt's reasoning: he seems to think that *all* diffusion with low slopes at low temperatures is exhaustible, as exhaustible as surface diffusion. He ignores the most likely mechanisms for low-temperature diffusion, which are as inexhaustible as volumic diffusion. So he thinks we should simply ignore Farley's low-temperature data, because he thinks it represents only a tiny fraction of the helium in the zircon.

But Loechelt is ignoring important evidence against his assumption. The first nine steps of Farley's experiment,[10] whose diffusivities he told us to ignore, cooked out 4% of the total helium in the crystal. The very next step, number 10, 1 hour at 500°C, cooked out an additional 11%. I would think that any exhaustible diffusion mechanisms would no longer be represented after that point, and that the remaining 85% of the helium, whether measured at low temperatures or high ones, would be from sources as inexhaustible as volumic diffusion. So there is no reason to ignore Farley's low-temperature data, as Loechelt wants to do.

Summary of Loechelt's main strategy:

1. Assume Farley's low-temperature data are from an *exhaustible* diffusion mechanism yielding less than a few percent of the total helium in the zircon.
2. Ignore the low-temperature data altogether. In effect, that is assuming that the zircons are near-perfect crystals, having almost no defects or impurities.
3. Extrapolate the high-temperature data down to low temperatures.

A math digression

If you have a severe Algebra Allergy, you might want to skip this section. Or you could do like most people do (including physical scientists in a hurry), and simply read the text, look at figure 6 and its caption, and skip the equations themselves. But I must bring this up simply because Loechelt brought this up. He wants to know how I got an equation I used in my general introduction[11] to diffusion:

$$D = D_0 \exp\left(-\frac{E_0}{RT}\right) + D_1 \exp\left(-\frac{E_1}{RT}\right) \qquad \text{(A)}$$

(The symbol 'exp' is the exponential function). The answer is that it is simply an *approximate* equation fitting the typical shape of the diffusion curves seen in experimental data. Figure 6 shows the curve I showed in that discussion. Its caption explains what the different symbols mean. We can derive the exact equation for the curve from the general Arrhenius equation (F&K, p. 73):

$$D = D_\infty \exp\left(-\frac{Q}{RT}\right) \qquad \text{(B)}$$

where D_∞ is a constant giving the overall diffusivity at infinite temperature and Q is the overall activation energy, which can have several components (F&K, p. 74):

$$Q = E_0 + E_1 \qquad \text{(C)}$$

Now define D_∞ as the product of two constants related to each component of diffusion:

$$D_\infty = D_0 D_1 \qquad \text{(D)}$$

Now put equations (C) and (D) into eq. (B) and take the natural logarithm of both sides of the result:

$$\ln D = \underbrace{\ln D_0 - \frac{E_0}{RT}}_{\text{High-temp line}} + \underbrace{\ln D_1 - \frac{E_1}{RT}}_{\text{Low-temp line}} \qquad \text{(E)}$$

This describes the curve of figure 6 more exactly, since the figure's vertical scale is logarithmic. But in regions where one term is much larger than the other, then equations (A) and (E) give nearly the same diffusivity. This should satisfy Loechelt's questions about the validity of eq. (A). It doesn't

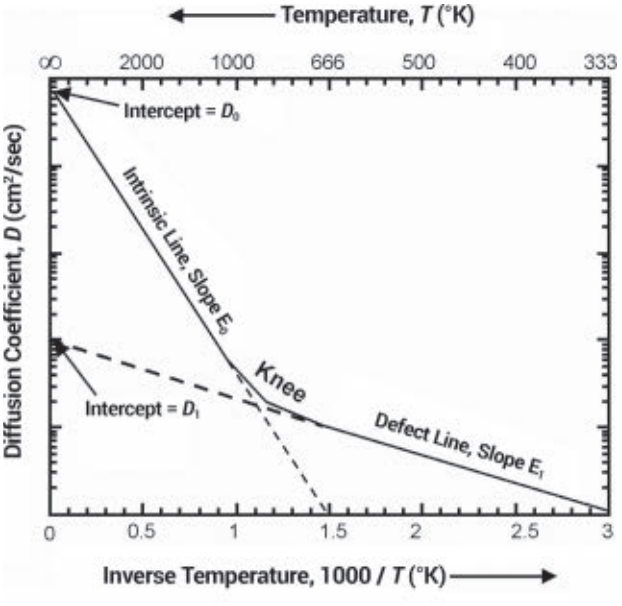

Figure 6. Typical two-slope curve of diffusivity D versus inverse of the absolute temperature T. E_0 and E_1 are the 'activation energies' of each diffusion mechanism; D_0 and D_1 are constants given by the intercepts on the left side of the curves above; and R is the gas constant.

matter anyway, because I didn't use eq. (A) in the other sections of the paper.

Did Farley interpret his data correctly?

Loechelt claims that the simple equations (by which Farley converted his measurements to diffusivities) do not apply in the case of the low-temperature data. The equations are given by F&K, pages 70–72. However the equations appear to apply quite generally, and at the bottom of page 71, F&K even discuss using the equations in the low-temperature range … and they make no caveats about that. Their only warning is to not use results from the initial steps. Those steps are needed only to make the helium or argon have a uniform distribution within the crystal, without a rounded fall-off at its edge. I would add that discarding the diffusivities from those steps also gets rid of the effects of 'loose' helium at or near the surface of the crystal.

Most important, Farley is much more of an expert than Loechelt on helium diffusion in geologic minerals, and Farley had no hesitation about using the F&K equations.

Were the zircons once much colder?

In two letters[12,13] to *Journal of Creation*, Loechelt argued that temperatures (deep in the granitic formation where the zircons were) were much lower than they are now for a long time, only having risen to today's levels fairly recently, within thousands of years. He doesn't appear to have taken my replies[14,15] to heart. But now that I understand his thinking better, I can shape my answers more clearly for him. I hope I can clarify the complexities for the readers.

Figure 7 shows why Loechelt wants lower temperatures in the formation. The six black squares connected by lines labelled 'Now' show the diffusivities the zircons would have to have to retain the observed amounts of helium for 1.5 Ga, if the formation had always been at today's temperatures. Those are all below the dashed red line showing the diffusivities Loechelt wants the zircons to have. But if we slide the 'Now' points about 100°C to the left (cooler) to where the white squares are, the warmest (right-most) three white squares will line up fairly well with the dashed red line. These 'Cold' points show the (low) temperatures the formation would have to have to retain the observed amount of helium for 1.5 Ga. The coldest (left-most) three white squares do not coincide with the dashed red line, so Loechelt would have to invoke some additional mechanism to explain the flattening there.

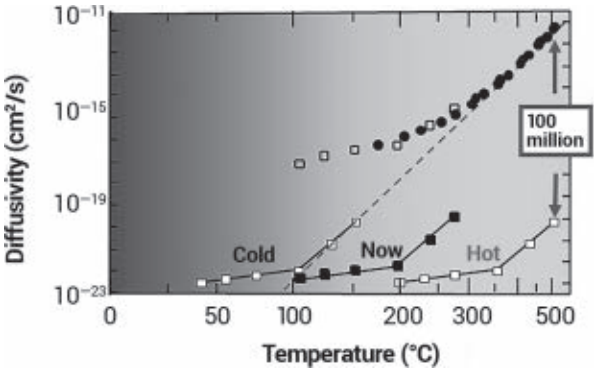

Figure 7. Squares with solid lines show diffusivities necessary with various scenarios for the temperatures in our borehole. Dashed line gives the diffusivities Loechelt wants for the zircons, in contrast to the black circles showing the diffusivities Farley measured.

If the formation was at the low temperatures for all but the last few thousand years, the 'Cold' set of white squares would be a reasonable approximation of the diffusivities Loechelt wants.

But what were the actual temperatures the formation experienced in the past? Loechelt cites several papers. One published in 1978 is by two Los Alamos scientists, C.D. Kolstad and T.R. McGetchin. It shows computer simulations of the heating from a nearby volcanic eruption during the Ice Age (Pleistocene). They assumed, as does Loechelt, that the radioisotope dating of the eruption, 1.04 Ma ago, is correct. (Creationists think the eruption was only thousands of years ago and would have an entirely different reconstruction of the temperature history.)

Figure 8 shows their results at different depths in the location of our borehole (called GT-2; figure 9), for two scenarios on the size of the underground magma chamber (pluton) that fed the eruption. The dashed line is at a depth

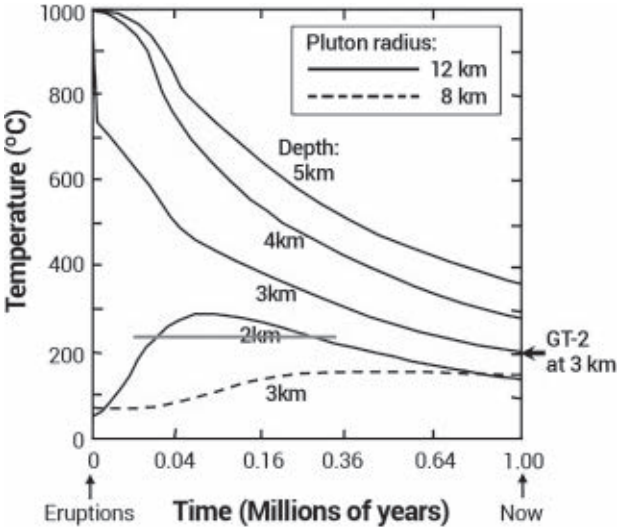

Figure 8. Heat models from Kolstad and McGetchin (1977), showing decreasing temperatures in our borehole (GT-2) at various depths. Timescale gives alleged millions of years after eruption of the nearby volcano. Horizontal line shows a range of possible times for the (time undetermined) peak temperature, 230°C, which Sasada (1989) measured for a depth of 2.6 km.

of 3 km for a pluton radius of 8 km. The solid lines show the temperatures versus time for a 12 km pluton radius at various depths, from 2 km down to 5 km. The arrow on the right shows the measured temperature of GT-2 today at a 3 km depth, about 200°C. The dashed line (8 km pluton radius, depth of 3 km) falls about 50°C short of the measured temperature at that depth. Notice that at about 0.2 Ma after the eruption, the dashed line is almost level. That is, that scenario would have the temperatures be roughly *constant* at today's observed temperatures for about *800,000* years.

The solid lines (12 km pluton radius) have *much higher* simulated temperatures in the past than now. The line for 3 km depth lines up on the right with today's measured temperature (arrow labelled GT-2).

Loechelt also cites a *measured* temperature by M. Sasada (1989) for the same site.[16] Looking at fluid inclusions in the formation, Sasada deduced that at a depth of 2.6 km, the temperature rose to a peak of about 230°C at some time, and then subsided. His technique did not assign a time for the peak. In figure 8, I have drawn a horizontal line at 230°C showing a range of possible times for the peak temperature at 2.6 km depth. The measured temperature today at that depth is about 178°C. So Sasada's measurement says that the temperature at 2.6 km depth *decreased* about 50°C sometime during the past history of the formation. He does say that other inclusions record a minimum temperature of 152°C at the same depth, but there is no way of knowing whether that occurred before or after the peak temperature. Sasada suggests it happened after the peak, but the minimum temperature could just as well have occurred right before the volcano erupted.

If Kolstad and McGetchin were to do another simulation with somewhat different parameters, say a pluton radius of 10 km and a somewhat higher initial temperature for the formation, they could probably generate a set of curves that agree with both the present borehole temperatures and also with Sasada's results. In that case the simulated temperatures would probably *decrease* by scores of degrees for the past *500,000 years* or so.

Loechelt wouldn't like my using the Kolstad and McGetchin results to interpret Sasada's maximum temperature as occurring after his minimum temperature. That's because it would mean the formation was hotter than today for hundreds of thousands of years, gradually cooling down to today's temperatures. That's not what Loechelt wants. Even if the formation temperatures had only been roughly constant at today's values for a half-million years, there would be much less helium left in the zircons … even using Loechelt's preferred low diffusivities.

Table 2. Observed and theorized helium retentions in the zircons

Sample	Temperature (°C)	Observed Retentions (%)	Loechelt Retentions (%)
1	105	58	4.5
2	124	42	0.6
3	151	27	0.1
4	197	17	0.002
5	239	1.2	0.00003
6	277	0.1	0.000003

In table 2 are the results of a simple calculation[17] of the retentions Loechelt's diffusivities would imply. The Loechelt retentions are calculated for the temperature having been constant at today's levels during the past half-million years. If the temperatures had been higher, as Sasada's measurement and most of the simulations imply, Loechelt's retentions would be even lower than observed.

A dissenting temperature history

Loechelt prefers a 1986 paper by T.M. Harrison, P. Morgan, and D.D. Blackwell. It looks at argon from potassium decay in feldspar in a nearby borehole (EE-2, not GT-2). They concluded (from the amount of argon lost) that there had been only thousands of years' worth of diffusion in the feldspar. Since they believe that the feldspar has existed for over a billion years, they were compelled to assume that the diffusivities were very low up to a few thousand years ago. That is, they assumed that the temperature of the formation increased considerably and rapidly up to today's values within only thousands of years ago. There are two problems with this scenario:

1. Kolstad and McGetchin's simulations show that temperatures can't change all that fast (over a few thousand years) in this particular formation. That's because the rock is dry, so heat can move only by conduction, which is quite slow in rock.
2. It assumes what Loechelt wants to prove, namely that the earth is old.

On the second point, I have published a technical paper[18] and a popular article[19] that works out the alternative possibility: that the feldspar has not existed for a long time. The Harrison *et al.* data then imply that the feldspar is only about 5,000 years old, in agreement with our helium-in-zircon data.

In summary, Loechelt wants to ignore the likely possibility (in his own long-age worldview) that the nearby volcano would have heated the formation significantly.

Answering the *ad hominem* attacks

Unfortunately, Loechelt makes a number of attacks on my character. He resembles a prosecuting attorney trying to undermine the credibility of a witness for the defence. That suggests to me that Loechelt feels the facts themselves do not support his case as strongly as he would like. Here are the two most serious of his character allegations:

Humphreys is dishonest—Loechelt thinks that (1) we invented Zodiac Mining and Minerals Inc. solely to be our intermediary with our experimenter Farley, and that (2) we instructed Zodiac to lie about our funding the experiments. On the first accusation, Zodiac was a legitimate business that existed before we asked them to approach Farley. On the second accusation, Zodiac didn't lie to Farley. We merely asked Zodiac to not *volunteer* the fact that they were working for creationists. If Farley had asked Zodiac, 'Are creationists paying for this?' we would have acknowledged that. Zodiac made a simple commercial contract with Farley; they gave him money, and he analyzed the helium in the crystals. Though I was under no ethical obligation to do so, I told Farley in 2003 that we were creationists, in an email before we published our first paper with the results.[20] Farley wasn't happy about that, but he told me he still stands by his data.

Humphreys is withholding information—Loechelt thinks that Farley made a formal report on the all-important 2003 zircon data, and he thinks that I withheld the alleged report. But, in contrast to his earlier procedure (see his reports in Appendices B and C in the RATE technical book),[21] Farley didn't make a formal report on the 2003 data. He merely sent us an Excel file with the data, accompanied by a brief email. The unexpurgated 2003 zircon data[22] (the 2003 biotite data were not much different than his earlier biotite runs, so we left them out) are in the RATE technical book, and here is his cover email in full (highlighting is mine):

> From: Ken Farley [email address]
> Sent: Monday, June 30, 2003 11:57 PM
> To: Majdah Al-Quhtani [Zodiac employee]
> Subject: Re: Sample Instructions
>
> Majdah:
>
> Here are the two data sets in excel format, on zircon and biotite. They look more or less the same as we have already seen. The basic outline of what I did is the same as in the past with the excpection [*sic*] that I weighed the samples to get total He concentration, so I did not bother with another summary report. Let me know if you need help understanding the data files or interpreting the data.
>
> Ken
>
> Ken Farley
> Division of Geological and Planetary Sciences
> MS 170-25
> California Institute of Technology
> Pasadena, CA 91125
> [Plus phone and fax numbers,
> email address and
> list of two attachments, the Excel data files on the biotite and zircon.]

Loechelt made other attacks on my character, and also on my competence as a scientist. But I don't find them to be particularly relevant to the scientific issues, so I'll let them slide. However, I would like Dr Loechelt to know that I'm not holding any grudges against him for his *ad hominem* tactics.

What the prediction means

In the late 1990s I estimated what diffusivities would give the observed retentions if the earth were 6,000 years old. Although the math is a bit complicated, essentially all it amounts to is dividing the amount of helium lost from the zircons by 6,000 years. That gives a rate of loss, which gives the diffusivity. These are the '6,000 year' diamonds in figure 2. I knew that temperatures in the formation could not naturally change much in only thousands of years, so I connected each diffusivity value with the temperature of that sample in the borehole today.

I had no idea whether the yet-to-be measured diffusivities would agree with the prediction, except that scaling from other measurements seemed to give results within an order of magnitude or so. We published this prediction in 2000 in a hardcover book (reference 6). If the data turned out to be different than the prediction, I had no way to change the prediction. I was out on a limb.

Three years later, Farley did his experiments on our zircons. He didn't know what results we wanted, and we didn't tell him. I remember well when I first plotted out Farley's data (the dots in figure 2) on a graph which already had the prediction on it. I was astounded at how well the data lined up with the prediction, because real-world diffusivities can differ from each other by factors of thousands to billions. A lineup would be exceedingly unlikely if there was something seriously wrong with either the prediction or the experiment.

The fulfilled prediction shows that the most straightforward understanding of the diffusion processes in the formation is the right one. If something weird was going on, as Loechelt alleges, it is very unlikely that the agreement we got would have occurred. This should build confidence, even in a non-expert, that our results are valid.

Summary

In my opinion, most of what Loechelt said in his two-hour presentation was neither new nor particularly cogent. I think we can boil his criticisms down to two essentials:

1. He thinks he can ignore Farley's low-temperature data, and
2. He thinks he can ignore simulated and measured past temperatures in the formation.

If either (1) or (2) are incorrect, then his case collapses. I have given evidence above that both assumptions are incorrect, so his case would then be doubly dead. On the other hand, the most straightforward interpretation (that is, without imagining strange and exotic processes) of the data is that the zircons are roughly 6,000 years old.

Epilogue: why this is important?

This helium argument is a sample of over 100 pieces of evidence[23, 24] that the world is young, not billions of years old as most of us (including me) have assumed. That's important, because the pervasive opinion that the world is old is one of the most serious impediments to taking the Bible at face value, as historical and scientific truth. That was the case for me many years ago as a young, atheistic, and rather arrogant, grad student in physics. As I began to read the Bible, I began to learn some bad news and some good news. Part of the bad news was that the human race is suffering from a fatal disease of the soul, which the Bible calls sin.[25]

Most people, including me, do not naturally think of this disease as being something very serious. We tend to minimize the symptoms of our condition with thoughts like:

> "I only lie occasionally, and for a good purpose … the company condones a little pilfering of low-priced things … sometimes I have lustful thoughts about my neighbour's wife, but that's natural … and yes, I hate some people, but they really deserve it."

Most of us, including me, think we're fairly nice people. If there really is a heaven, God wouldn't keep us out of it, especially not send us to that other place, would He?

The really bad news, I found, is that God hates all sin intensely and must judge it.[26] If we don't accept His remedy[27] for our disease, and instead cling to our sin, there is no place in His new cosmos[28] for us but isolation in what Christ called 'eternal fire'.[29]

The really good news is that God has provided a remedy for our disease. He loved you and me so much that He sent his only-begotten Son into the world to die on the cross, taking upon Himself as our substitute the penalty, death, which we deserved for our sins … so that whoever believes on (trusts in, commits to, relies upon) Jesus Christ might not perish, but have everlasting life. Most of that comes from John 3:16, that verse which most people know but few ever think about. The substituting death of the Messiah is in Isaiah 53:6,[30] written seven centuries before the time of Christ. I hope you will find, as I have, the abundant life that Christ promises.[31]

The helium results are also important to the minority of you here who are genuine Christians, but who believe the world is billions of years old. I think Dr Loechelt and Dr Ross are in that class. I understand your point of view from personal experience. After I had accepted Christ as my Saviour, I was an evolutionist for about one year. I was doing what comes quite naturally, trying to fit what I had been taught all my life (billions of years of physical and biological evolution) into the Bible that I was beginning to learn. I thought God caused the evolution, but behind the scenes.

However, the fit wasn't too good, and I wasn't happy with it. After about a year, two things happened. The first was that someone suggested to me that the Flood in Genesis, chapters 6–9 was a worldwide event, and that it would have buried all the fossil-bearing strata during one year. The second was reading a book by Henry Morris, *Biblical Cosmology and Modern Science*. It listed some of the evidence for a young earth that I mentioned in the first sentence of this epilogue. That evidence was what made me a young-earth creationist.

My dear Christian brothers and sisters who believe the earth is old, I get the impression that you *want* to resist the same evidence that convinced me. Is that because you think that the consensus of scientists can't be wrong? When I worked at Sandia National Laboratories, I discovered something surprising about that consensus: it's not based on a study of the evidence. I found that that *most scientists believe the world is old simply because they believe that most other scientists believe the world is old!* The idea was just 'in the air' ever since their youth, as it was for me, and most of them believed it because it had never occurred to them to question it.

Figure 9. Rig which drilled borehole GT-2, at Fenton Hill on the western rim of the Valles volcanic caldera, about 30 km west of Los Alamos, New Mexico, US

Or do you believe that non-Christian scientists are too objective to be influenced by their deep desire to imagine an old world without a Creator? Surely you have found out that all of us, scientists or non-scientists, are powerfully moved by our biases, especially when the religious stakes are high. Last, perhaps some of you are moved by peer pressure; it's just easier to go with the majority and conform to its ideas. I appeal to you, my brothers and sisters, to stop being conformed to this age and instead be transformed by the renewing of your minds.[32] Then you will find that all the scientific evidence for a young world[22,23] is actually quite good news for you.

References

RATE I: *Radioisotopes and the Age of the Earth*, vol. I, Vardiman, L. Snelling, A.A., and Chaffin, E.F. (Eds.), Institute for Creation Research, El Cajon, CA, and Creation Research Society, St Joseph, MO [Not Creation Research Society, Chino Valley, AZ?], 2000; icr.org/i/pdf/research/rate-all.pdf.

RATE II: *Radioisotopes and the Age of the Earth*, vol. II, Vardiman, L. Snelling, A.A., and Chaffin, E.F. (Eds.), Institute for Creation Research, El Cajon, CA, and Creation Research Society, Chino Valley, AZ, 2005; icr.org/rate2.

1. Great Debate Community, youtube.com/channel/UCgnIsA-D3PX6g6gi6Nyuewg.
2. Loechelt, G.H., Helium Diffusion in Zircon and Accelerated Nuclear Decay, 2018. PowerPoint presentation, youtube.com/watch?v=HmhHLJaH-w0.
3. Institute for Creation Research RATE resource page, icr.org/rate/.
4. RATE II, see above.
5. Humphreys, D.R., RATE II, chap. 2, icr.org/i/pdf/technical/Young-Helium-Diffusion-Age-of-Zircons.pdf.
6. Humphreys, D.R., RATE I, chap. 7, p. 348, figure 7, icr.org/i/pdf/research/rate-all.pdf.
7. Humphreys, D.R., creation.com/helium-evidence-for-a-young-world-continues-to-confound-critics.
8. Fechtig, H. and Kalbitzer, S., The diffusion of argon in potassium-bearing solids; in: , Schaeffer, O.A. and Zähringer, J. (Compilers), *Potassium Argon Dating*Springer-Verlag, New York, pp. 68–107, 1966; pp. 85–86.
9. Girifalco, L.A., *Atomic Migration in Crystals*, Blaisdell Publishing Company, New York, 1964. See pp. 82–89, 99–104, 117–130.
10. Humphreys, D.R., RATE II, p. 45, Table 2, Steps 9 and 10, "Cumulative Fraction" column.
11. Humphreys, D.R., RATE II, p. 34, eq. (3). I've corrected a sign typo in the original.
12. Loechelt, G.H., Critics of helium evidence for a young world now seem silent, *J. Creation* **24**(3):38, 2010; creation.com/images/pdfs/tj/j24_3/j24_3_34-39.pdf.
13. Loechelt, G.H., Argon diffusion data supports RATE's 6,000-year helium age of the earth, *J. Creation* **26**(2):45-48, 2012; creation.com/images/pdfs/tj/j26_2/j26_2_45-49.pdf.
14. Humphreys, D.R., Russell Humphreys replies, *J. Creation* **24**(3):39–43, 2010; creation.com/images/pdfs/tj/j24_3/j24_3_34-39.pdf.
15. Humphreys, D.R., Russell Humphreys replies, *J. Creation* **26**(2):48–49, 2012; creation.com/images/pdfs/tj/j26_2/j26_2_45-49.pdf.
16. Sasada, M., Fluid inclusion evidence for recent temperature increases at Fenton Hill hot dry rock test site west of the Valles Caldera, New Mexico, US, *J. Volcanology and Geothermal Research* **36**:257–266, 1989.
17. Humphreys, D.R., RATE II, p. 53, eq. (16), assuming that a half-million years at high temperature is long enough to eliminate most of the helium accumulated from the previous 1499.5 million years at a lower temperature.
18. Humphreys, D.R., Argon diffusion data support RATE's 6,000-year helium age of the earth, *J. Creation* **25**(2):74–77, 2011. Colour photos at: creation.com/argon-diffusion-age.
19. Humphreys, D.R., Argon from RATE site confirms the earth is young, *Creation* **34**(3):40–42, July-September, 2012; creation.com/argon-from-rate-site.
20. Humphreys, D.R., Austin, S.A., Baumgardner, J.R., and Snelling, A.A., Helium diffusion rates support accelerated nuclear decay; in: Ivey, R.L. (Ed.), *Proceedings of the Fifth International Conference on Creationism*, Creation Science Fellowship, Pittsburgh, PA, pp. 175–195, 2003. Hardcopy or CD of Proceedings available at: creationicc.org/.
21. Humphreys, RATE II, pp. 77–83.
22. Humphreys, RATE II, p. 45, table 2.
23. Batten, D., Age of the earth: 101 evidences for a young age of the earth and the universe, 2009, creation.com/age-of-the-earth, updated 13 September 2017.
24. Humphreys, D.R., Evidence for a young world, *ICR Impact*, June 2005, icr.org/i/pdf/imp/imp-384.pdf.
25. "All have sinned, and fall short of the glory of God" (Romans 3:23; all quotes here from NAS Bible).
26. "The wages of sin is death …" (Romans 6:23).
27. "… but the gift of God is eternal life in Christ Jesus" (Romans 6:23).
28. "Then I saw a new heaven and a new earth …" (Revelation 21:1).
29. "Then He will say to those on His left, 'Depart from Me, accursed ones, into the eternal fire which has been prepared for the devil and his angels'" (Matthew 25:41).
30. "All of us like sheep have gone astray, each of us has turned to his own way; but the Lord has caused the iniquity of us all to fall on Him" (Isaiah 53:6).
31. "… I have come that they may have life, and have it more abundantly" (John 10:10).
32. "And do not be conformed to this world, but be transformed by the renewing of your mind, so that you may prove what the will of God is, that which is good and acceptable and perfect" (Romans 12:2).

D. Russell Humphreys *Ph.D., is a physicist. In 2001, after 22 years, he retired from Sandia National Laboratories to work for the institute for Creation Research, and then Creation Ministries International, until 2010. He resides in Chattanooga, TN, USA, writing and doing creation science research. He is a long-time board member of the Creation Research Society and occasionally speaks on its behalf.*

Hydroplate Theory—problems for trench formation in the Pacific Basin

Edward Isaacs

Hydroplate Theory (HPT) is one of several models proposed in the last few decades to understand the Global Flood's initiation and later tectonic activity. It claims to explain 25 major features of the earth, including oceanic trenches. However, this article questions HPT's proposed formation mechanism for the Pacific trenches. First, the trenches are not located where predicted by HPT, and are far from their proposed origin. Second, the proposed central trench complex is missing. Therefore, HPT is unable to explain the origin of the Pacific Ocean Basin and the Pacific trenches.

Introduced in 1972 by Dr Walt Brown, the Hydroplate Theory (HPT) was developed as a biblical model for the Global Flood's initiation and subsequent tectonic activity. This model has continued to be refined in eight editions of Dr Brown's book *In the Beginning*,[1] which is soon to be in its ninth edition.[2] HPT is claimed to explain 25 major features of the earth.[3]

One topic addressed by HPT is the network of Pacific Ocean trenches.[4] Plate Tectonics (PT) and its creationist form, Catastrophic Plate Tectonics (CPT), present these features as subduction zones, where lithospheric plates had catastrophically moved (CPT) or steadily moved (uniformitarian PT), and continue to gradually move, into the mantle. In contrast, HPT proposes that a complex sequence of unique events occurred at the time of the Flood which formed the Pacific trenches (table 1).

This study used Google Earth seafloor images to estimate the location of HPT's proposed central trench complex, and compared those expectations to the actual seafloor trench features.

Overview of Hydroplate Theory

HPT sets out a unique set of initial conditions prior to the Flood. The model proposes an interconnected shell of subterranean water, approximately 1.6 km thick, separating a 100-km-thick upper granitic crust from an underlying zone of basalt (figure 1). It is assumed that from years of tidal pumping from the moon, this subterranean water had become supercritical, a phase when liquid water is "at a temperature and pressure above its critical point, where distinct liquid and gas phases do not exist".[5]

At the onset of the Flood, crustal failure caused the supercritical water to jet out, forming cracks in the overlying granite layer. HPT has these jets of water as the fountains of the great deep described in Genesis 7:11. The combined work of the fountains of the great deep and the rain it produced began the inundation of the continents (figure 2A). This upward surge of water caused massive erosion of the granitic crust, which resulted in the separation of the continents.

Eventually a critical point was reached where the granite crust was eroded so far apart that the underlying basalt buckled upward from the lack of the overlying pressure. This is claimed to have formed the Mid-Atlantic Ridge, or MAR (figures 2B and 2C).

Magma in near proximity would then have rushed to the MAR to fill the void space created when it uplifted (figures 3 and 4). This shifting of magma caused the magma on the opposing side of Earth (the Pacific Basin) to flow inward, causing the Pacific oceanic crust to down-buckle. Where the oceanic crust down-buckled it formed the central trench complex, the antipode to the rising MAR (figure 4). Because of the stress placed on the unsupported Pacific crust, it quickly collapsed and sheared (faulted) along its boundary, forming the Ring of Fire, or the boundary trench complex.

HPT further proposes that while the central trench complex was forming in the Pacific Basin, the granite continents slid laterally to their current locations, with some continental collisions producing the major mountain ranges we have today.

Plotting the central trench complex based on the MAR

One of the major features predicted by HPT is the development of the central trench complex (figure 4). Dr Brown states:

> "Further shrinkage in the inner earth caused the Pacific crust, surrounded by what is now call [*sic*] the Ring of Fire, to begin sinking. Portions of the Pacific crust directly opposite the center of the rising Atlantic floor buckled inward, forming trenches."[6]

Furthermore:

"By the end of the flood phase, the Pacific plate's sagging foundation had fractures in millions of places, and the magma generated along the deep sliding surfaces instantly contracted. Therefore, the Pacific plate, lacking support, rapidly subsided and sheared around its perimeter—now called the *Ring of Fire*."[7]

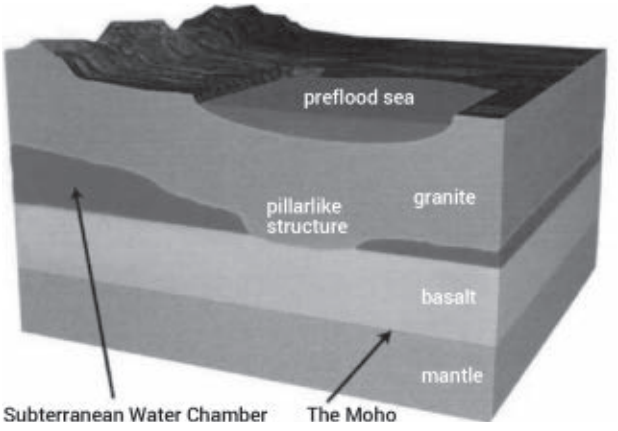

Figure 1. Representation of the Hydroplate Theory's proposed pre-Flood Earth's initial condition crustal structure (from Brown, ref. 2, figure 55 on p. 126)

These statements identify two major locations for trench formation. The first class of trenches would buckle downward concomitant with the rising MAR on the other side of the earth. These trenches would form in the centre of the Pacific Basin, at the location identified by HPT as the central trench complex (figure 4). A second group of trenches would form at the Pacific Basin's perimeter, identified by HPT as the boundary trench complex, or shear trenches. These trenches would comprise the circum-Pacific belt trenches, or the Ring of Fire. These boundary trenches differ from Plate Tectonic trenches because HPT postulates that the Pacific Basin sank and sheared apart from the surrounding crust, constituting the Pacific Basin as one 'plate', while Plate Tectonics theory proposes multiple plates subducting into the earth along the Pacific's perimeter.

HPT's predictions for the location and the orientation of the central trench complex in the Pacific Basin can be used to plot the region directly opposite the MAR. This has been performed by plotting the MAR in the Atlantic (figure 5), followed by plotting the antipodes, shown in figure 6.

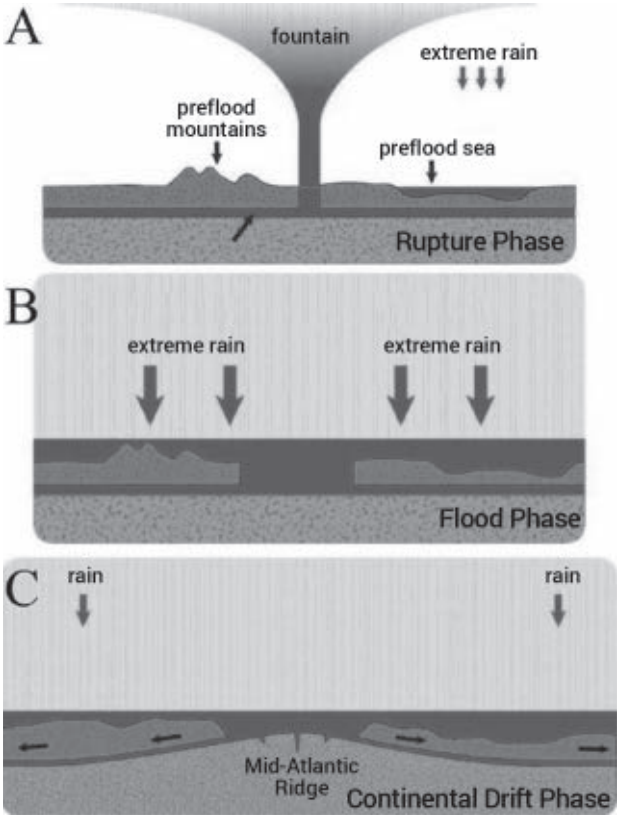

Figure 2. HPT's proposed phases: (A) the Rupture Phase—the fountains of the deep rupture, initiating the Flood; (B) the Flooding Phase; and (C) the Continental Drift Phase including uplift of MAR. (From Brown, ref. 2, figures 57, 60, and 64, pp. 127, 131, and 133.)

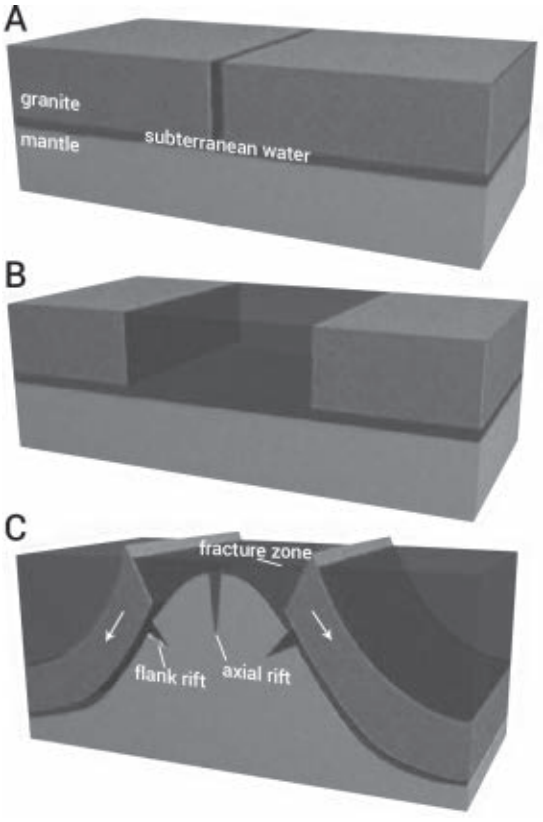

Figure 3. Proposed HPT formation of the MAR: (A) rupture and release of supercritical water; (B) rupture erodes laterally; and (C) uplift of MAR by buckling basaltic layer caused by absence of granitic overburden. (After Brown, ref. 2, figure 66, p. 134.)

The markers used in figure 6 denote the location opposing the MAR, showing where the predicted location of the central trench complex should be located. The plot indicates the close association of the central trench complex with several Western Pacific trenches. Beginning with the northernmost marker, Marker A, the plot begins in modern-day Siberia. Then moving south, it moves west of Japan and the Japan Trench (Marker B). Next, the plot cuts across Mariana Trench to the south-west. It continues south-eastward until it reaches the southern tip of New Zealand (Markers C to G), before terminating over 2,400 km north of Antarctica (Marker H).

Where should the central trench complex be in the Pacific Basin?

The central Pacific (figure 7) is the ideal location for HPT's central trench complex, with the western and eastern boundary trenches (formed from shearing) roughly equally apart from the central trench complex. However, since the MAR is not always in the centre of the Atlantic Basin, the location of the central trench complex may vary by an equal distance. An antipode of the actual MAR (figure 8) would transect Hawaii, then move east to subsequently proceed southward. Near the equator, it would again trend east, then south once more before making a sharp turn east less than 2,500 km north of Antarctica.

A comparison of this predicted location with the Pacific seafloor demonstrates the absence of any central trench complex, as there is no equivalent feature that transects the Hawaiian Islands. Nor is there any further south, at locations like Kiribati and the Line Islands, or near the Tuamotu Ridge, east of French Polynesia. The predicted trench complex terminates in the South Pacific near a large oceanic ridge, the

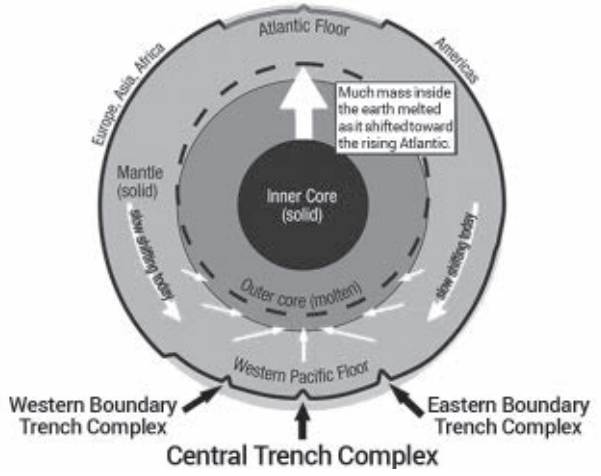

Figure 4. HPT mechanism forming two types of Pacific trenches: (1) central trench complex mirroring MAR and (2) boundary trench complex formed by shearing as the Pacific Plate shifted towards the MAR, shearing (faulting) at its boundary. (After Brown, ref. 2, figure 85, p. 157.)

Table 1. Summary of the chronology of Hydroplate Theory

HPT Period	Geological Events
Creation	God creates Earth's pre-Flood structure (basalt basement rock overlain by interconnected water chambers and granitic crust).
Pre-Flood period	Subterranean water becomes supercritical.
The Flood: Rupture Phase	Granitic crust cracks, allowing subterranean water to jet out (fountains of the great deep) and inundate the continents. Crack encircles Earth in two hours.
The Flood: Flood Phase	Subterranean water continues to inundate the continents. Floodwaters rise.
The Flood: Continental Drift Phase	Mid-Atlantic Ridge (MAR) buckles upward, forming antipode Pacific trenches. Continents slide away from the MAR.
The Flood: Compression Event	Mountains form from the collisions and halting of the hydroplates during the Continental Drift Phase. Continents rise above the floodwaters causing the floodwaters to recede.
Recovery Phase	Floodwaters recede from the continents, ending the Flood. Continents begin to stabilize. The Ice Age begins. Phase continues to the present.

Table 2. Overview of data from figure 6. Respective markers and their status for the Hydroplate Theory are given.

Marker	Challenges to the Hydroplate Theory
A. Arctic Circle by 165° East	Located on the NE Eurasian Hydroplate
B. 40° North by 150° East	Incorrect location in Pacific Basin
C. Tropic of Cancer by 135° East	Incorrect location in Pacific Basin and wrong association to large ridge
D. 10° North by 140° East	Incorrect location in Pacific Basin and wrong association to ridge
E. 0° by 160° East	Incorrect location in Pacific Basin
F. Tropic of Capricorn by 165° East	Incorrect location in Pacific Basin
G. 45° South by 165° East	Incorrect location in Pacific Basin
H. 53° South by 155° West	Incorrect location in Pacific Basin and wrong association with oceanic ridge

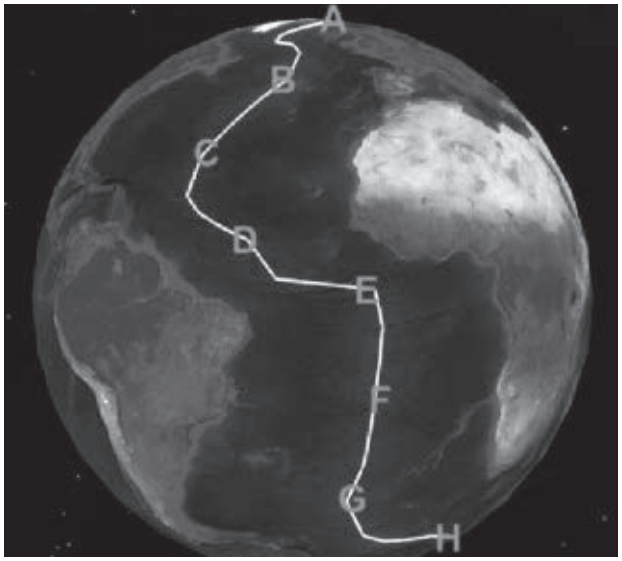

Figure 5. Proposed approximate motion of MAR. See table 2 for marker locations. (From Google Earth.)

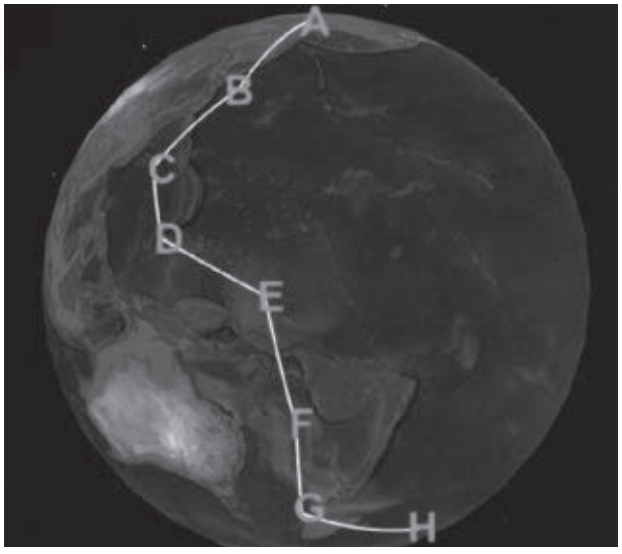

Figure 6. Mirror image of MAR plotted on Google Earth image (see table 2)

association of the postulated trench complex and an oceanic ridge system itself not predicted by HPT theory.

Can Hydroplate Theory explain the lack of a central trench complex in the central Pacific?

Figure 8 illustrates two important challenges to HPT:

1. HPT's proposed area for the central trench complex (Western Pacific) is far from where it should be in the central Pacific, and
2. Where the central trench complex *should* be (see above section), HPT's proposed central trench complex is found to be completely absent from the Pacific Basin.[8]

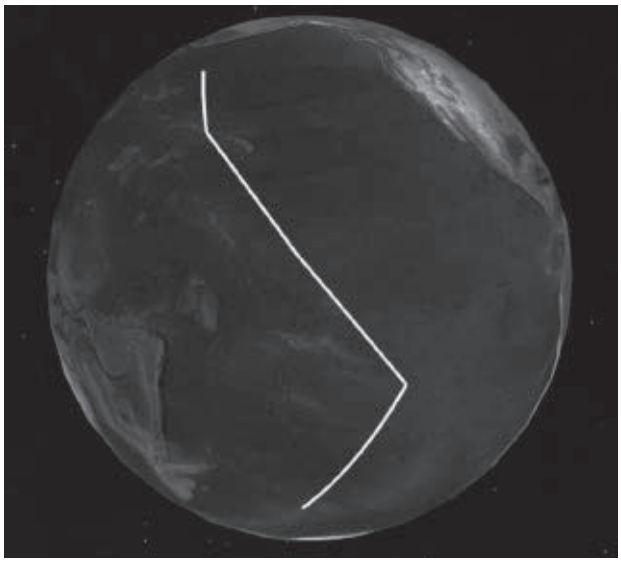

Figure 7. An approximation of the centre of the Pacific Basin is shown in the central line. It is along this line that the central trench complex (see figure 4) is most likely to be found. (After Google Earth.)

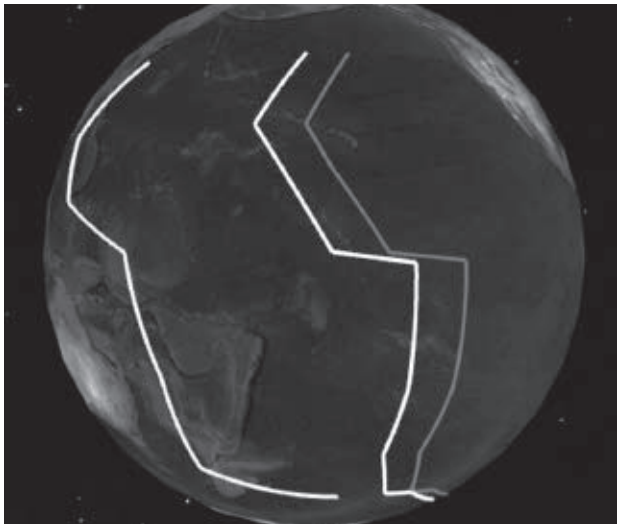

Figure 8. Picture showing Hydroplate Theory's predicted antipodal position for the central trench complex based on the MAR (far-left line) contrasted to where the central trench complex should be if HPT formed the Pacific Basin (middle-right two lines). Notice also the lack of a central trench complex where HPT would need it to be in order to form the Pacific Basin (centre lines). (After Google Earth.)

Although both points are challenging, HPT has a partial answer for the latter. HPT postulates that large lava flows covered the Pacific Basin during the compression event.[9] However, this explanation presents other challenges:

1. As the inverse of the MAR, the Pacific central trench complex should be extremely large and thus require copious amounts of lava to fill it. And even if the central trench complex was covered by lava flows it should be visible on seismic data.

2. Why would lava only cover the central trench complex? Why not other prominent trenches, especially boundary trenches since they too would have been in regions of extreme faulting and presumed magma generation?
3. These megaregional lava flows would create an excessive heat generation problem for HPT similar to that proposed for Catastrophic Plate Tectonics.[10,11,12]

Could the Western Pacific trenches compose the central trench complex?

Is it possible that the Western Pacific trenches like the Tonga Trench are not boundary trenches but comprise all or a portion of the central trench complex? While this suggestion would appear to solve the lack of HPT's proposed central trench complex in the centre of the Pacific Ocean, several inconsistencies and challenges would arise.

First, Dr Brown stated: "Large shearing offsets that reached the Pacific floor formed ocean trenches. [Wadati-] Benioff zones [places where mantle imaging shows the presence of what is interpreted as cold crust] under trenches are shearing surfaces (fault planes)."[7] Therefore, the Tonga trench tomography (mantle imaging) is explained as shearing at the Pacific Basin's rim, which demonstrates that the Western Pacific trenches do not comprise the central trench complex predicted by HPT. Likewise, the Ring of Fire is proposed to have formed from shearing at the Pacific Basin's boundary, further demonstrating that the Western Pacific trenches do not compose the central trench complex.

Second, while the plot showing the predicted location of the central trench complex opposite the MAR (figure 6) correlates well with the Western Pacific trenches from Markers A to E, the trenches and the plot diverge in moving further south. Continuing south, both the trenches and the plot become more perpendicular to the other, instead of continuing parallel as would be expected by HPT.

Another reason that the Western Pacific trenches do not represent the central trench complex is that the western boundary trenches would have to extend beneath central Africa. This creates several additional difficulties:

1. The western boundary trenches would be merely 40° Earth circumference from the Mid-Atlantic Ridge (MAR). HPT does not predict the buckling upward of the MAR to create a basin 260° wide (72% Earth's surface). Critics have questioned if the rising of the MAR could even form the Pacific Basin,[13] much less a basin twice as large.
2. A fundamental problem arises where the western boundary trenches and the south-east MAR/Indian Ocean Triple Junction would coincide in location, the association of a trench complex and an oceanic ridge system being contradictory to HPT predictions.
3. Similarly, if the western boundary trenches were beneath central Africa, then they would not be the antipode from the MAR. For example, at the equator, westward of the MAR the trench complex is 60° (6,800 km) away, while to the east the trench complex would only be 40° (4,400 km) away. This lack of symmetry between the proposed boundary trenches to the east and west of the MAR shows the unlikelihood of the up-buckling of the MAR to create these trenches as components of the central trench complex.

Further challenges to the proposed central trench complex being located in the Western Pacific

Although the proposed central trench complex could be linked with several trenches in the West Pacific, the HPT proposal faces several difficulties (table 2). First, although Marker C (figure 6) associates between the Izu-Ogasawara and Mariana trenches to the east and the Ryukyu Trench to the west and north-west, the marker is only 200 km east of the large seamount range Kyushu-Palau Ridge, as well as the smaller ridges Okidaito and Daito in the west and north, respectively. The presence of these large ridges surrounding Marker C is contrary to the HPT-predicted trench (figure 9). Similarly, though Marker D correlates well with the small Yap Trench in the west and Mariana Trench in the north, Marker D also correlates to several large seamount ranges in the north, west, and south, one of the largest ridges being Lapulapu near the Northern Mariana Islands.

Although the mid-Pacific region is the predicted location for the postulated central trench complex, the West Pacific location is indeed the case for virtually all the markers of the proposed central trench complex. Not only is Marker A nowhere near the central Pacific, it is of little relevance. Located in north-eastern Siberia, it is overlain by continental crust; at best, it must be assumed that this hydroplate slid across the trench during the continental drift phase (figure 2C). Markers B, E, F, and G are all far from the central Pacific. Marker H is the only marker that corresponds to both a trench and is near the centre of the Pacific. However, this

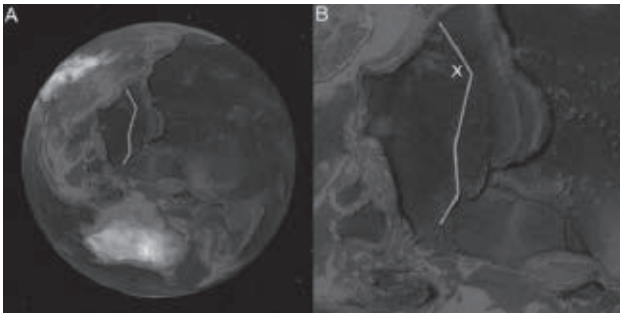

Figure 9. Example where: (A) proposed HPT trench is located near seamount range Kyushu-Palau Ridge (vertical line), with (B) closer view of the ridge. '*X*' denotes location of Marker C. (From Google Earth.)

trench is associated with a transform fault emanating from the mid-ocean ridge 2,600 km north of Antarctica. Table 2 provides a summary of the challenges to this location being the central trench complex.

Conclusions

Although the western circum-Pacific trench belt has been used as evidence of HPT,[14] the trenches are more problematic than have been previously thought.

First, while it has been shown that the proposed central trench complex (figure 4) is near several trenches comprising the western boundary trench complex, it also plots atop seamount ridges and ocean ridges, contradicting HPT predictions.

The central trench complex is supposed to be located exactly opposite the MAR, in the centre of the Pacific Basin. In this article, it has been shown that the antipode of the MAR associates with the western boundary trenches, instead of in the centre of the Pacific Basin. Simply stated, there is no central trench complex in the Pacific Basin as proposed by HPT.

These issues challenge HPT's overall plausibility—a theory claiming to address nearly all tectonic features, such as oceanic trenches, all around the earth. Further development of HPT is necessary to defend it using actual conditions and not model predictions. If this cannot be done empirically, then Hydroplate Theory may need to be rejected as a possible biblical Flood model.

Acknowledgements

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References

1. Brown, W., *In the Beginning: Compelling evidence for Creation and the Flood*, 8th edn, Center for Scientific Creation, Phoenix, AZ: 2008.
2. Brown, W., *In the Beginning: Compelling Evidence for Creation and the Flood*, 9th edn, CD-ROM, Center for Scientific Creation, Phoenix, AZ, 2017.
3. Brown, ref. 2, p. 113. These 25 major features of the earth are explained on pp. 113–124.
4. A whole chapter discusses the formation of the Pacific trenches. See Brown, ref. 2, The origin of ocean trenches, earthquakes, and the Ring of Fire, pp. 154–194.
5. Supercritical fluid, en.wikipedia.org/wiki/Supercritical_fluid, accessed 1 January 2018.
6. Brown, ref. 2, p. 155.
7. Brown, ref. 2, p. 159.
8. There are many trenches in the Pacific Basin that are not directly classified in the Ring of Fire. However, the trenches in the east (trenches which associate with the Juan de Fuca Plate trenches) are inadequate support for HPT, as they do not conform to the predicted manner of the central trench complex. While there are other trenches in the South Pacific, these associate with the South Pacific oceanic ridge system, therefore offering no support for HPT.
9. Brown, ref. 2, pp. 158–160.
10. Baumgardner, J.R., The imperative of non-stationary law in relation to Noah's Flood, *CRSQ* **27**:98–100, 1990.
11. Froede, C.R., Jr., The heat issue within Catastrophic Plate Tectonics, *CRSQ* **35**:46–47, 1998.
12. Baumgardner has proposed the possibility of excessive heat generation problems for all our current Flood models. See Baumgardner, J., Dealing carefully with the data, *J. Creation* **16**(1):68–72, 2002.
13. Oard, M.J., Analysis of Walt Brown's Flood model, creation.com/hydroplate-theory, 7 April 2013.
14. Nickel, B., *Hydroplate Theory overview: part 6*. www.youtube.com/watch?v=xayjxQOsexM&t=703s, accessed 2 November 2017.

Edward Isaacs *is a keen student of the sciences, especially geology. He has devoted the last seven years to intensive studies of Creation Science, primarily focusing on topics on the Genesis Flood and subsequent Ice Age. As a creation researcher, writer and speaker, Edward is very active in creation ministry and education and is a member of the Creation Research Society.*

Changing paradigms in stratigraphy—*another* 'new uniformitarianism'?

John K. Reed

After decades of flirtation with neocatastrophism, historical geology is edging back towards its first love, uniformitarianism. That relationship seemed doomed, thanks to exposure of Lyell's forced marriage of gradualism and uniformity. Uniformitarianism seemed washed up—diminished by fancy new semantics and set aside for a flashy neocatastrophism. But amid the uncertainties of 'more gap than record', geologists are reconsidering. Andrew Miall has proposed a 'new' uniformitarianism, where the incompleteness of the rock record is perceptually scale-dependent, and that linking physical and temporal scales can transform the 'frozen accidents' of the past into a coherent story. Analysis of his case shows otherwise.

Historical geology rests on uniformitarianism, whose equivocal meanings were long obscured by "the present is the key to the past". Its real meaning is as a philosophy of history that denies God's works of creation and providence.[1] Despite periodic assertions that gradualism has been rejected in favour of 'methodological uniformitarianism'[2] or 'actualism',[3] and despite flirtations with neocatastrophism,[4] geologists always return to gradualism because naturalism requires scientific certainty. Data may 'distract' them from gradualism for a time, but it always swings back. That is why the neocatastrophism of the late 20th century is being eased aside to ensure the slow, continuous sedimentation needed for the new stratigraphy.[5,6]

But a new deflection has disturbed the compass. The dramatic incompleteness of the sedimentary record has forced some to entertain doubt about major aspects of uniformitarian stratigraphy.[7] Two previous papers discuss this phenomenon. "Not enough rocks: the sedimentary record and Earth's past" questions the ability of uniformitarianism to account for the unexpectedly sparse volume of the planetary rock record.[8] "Changing paradigms in stratigraphy—'a quite different way of analyzing the record'" explores Bailey and Smith's[7] discovery of the self-similar nature of deposition and erosion at all scales in the rock record.[9] This implies a plethora of hiatuses, pauses, or breaks in continuity, in the rock record at all scales, most undetectable, and raises the possibility that the rock record is a series of undecipherable 'frozen accidents' at all scales with no causal connection between each other.

Nonetheless, few geologists see uniformitarianism as a philosophy. They 'know' it is true, even if they cannot define it, and both of these factors get in the way of logical analysis.[10]

Andrew Miall is a prominent Professor of Geology at the University of Toronto. His books are well known in petroleum geology and his walls are filled with professional awards. He has been a voice of caution against bandwagons like cyclostratigraphy (astronomically forced climate cycles within sedimentary successions).[11]

He sees this new problem with uniformitarianism and agrees it is of concern. However, he believes stratigraphy can be saved by an appeal to the scale of sedimentary processes and by rebranding uniformitarianism:

> "The significant differences highlighted in this paper between 1) the preservation of the products of modern sedimentary processes, 2) those preserved in the recent (post-glacial) record, and 3) those preserved in the more ancient record, indicate the need for a modified use in geological work of the concepts of *uniformitarianism* [emphasis in original]."[12]

Note that the bottom line is non-negotiable. Purposefully echoing Challinor[13] he affirms: "Uniformitarianism is still the fundamental principle on which geology is built".[14]

His attempt to reconcile the rock record and uniformitarianism is significant. That a geologist of his stature would address it shows the severity of the problem. It also shows that uniformitarianism is the heart of secular natural history,[15] and that anything can and will be sacrificed to preserve that core.[16] Moreover, creationists who have been leaning on neocatastrophism are in danger of disappointment if Miall can successfully rescue uniformitarianism.

The problem

In 1973, Ager revealed a trade secret: sedimentary processes should have left us a lot more rocks.[4] He saved deep time by embracing an incomplete record. That record became a series of "frozen accidents" and was "more gap than record". Fascinated with the obvious, geologists still refused the logical conclusion of diminished confidence in their natural history. Miall noted:

> "Notwithstanding observations such as this, stratigraphers have tended to operate as if continuous sedimentation was the rule. For example, many of the independent marker horizons in the GTS [Geologic Time Scale] were, at one time, dated by extrapolation or interpolation between well-dated beds (e.g. radiometric dates on bentonites) by assuming a constant sedimentation rate."[17]

Recently, some geologists have carried Ager's work further,[7] merging a fractal view of nature with neocatastrophism to arrive at a pessimistic assessment of traditional stratigraphy.

Fractal aspects of the sedimentary record

B.B. Mandelbrot (1924–2010) was a mathematician who coined the term 'fractal' to refer to natural phenomena that showed repeating complex patterns over wide scales. He used this concept to show that apparently random patterns in nature, such as coastlines, are self-similar at any scale. Mandelbrot's[18] ideas were well received in geology, with applications in geomorphology, sedimentology, and stratigraphy.[19] Plotnick[20] applied the scale-independent self-similarity of complex natural features to stratigraphic hiatuses, providing a mathematical basis for Ager's claim of "more gap than record". He noted:

> "Similarly, the distribution of unconformities appears at first glance to be hierarchical. For example, in the Phanerozoic of Northern Illinois, there are two large-scale unconformities … with durations of 600–900 m.y. and ca. 140 m.y., respectively … . Three other unconformities appear to range from 5 to 20 m.y. These five hiatuses largely correspond to the sequence boundaries of Sloss (1963). An additional six unconformities may be in the 1 to 2 m.y. range. Finally, there are, of course, many more unconformities represented by formation boundaries."[21]

This means that there are gaps of all sizes everywhere in the strata. Plotnick saw sedimentation as a Cantor function (a log-linear relationship between time and sediment accumulation) and developed a Cantor bar, popularly known as a 'devil's staircase' (figure 1) to show that hiatuses are more prevalent over time.

Sediment accumulation diminishes over time?

Miall agrees with all this, claiming that the increasing resolution of sequence stratigraphy confirms the fractal nature of the rock record.[22] He notes it is nothing new:

> "He concluded: 'only one-sixth of time is recorded' by sediments (Barrell, 1917, p. 797). This remarkable diagram 1) anticipated Jervey's (1988) ideas about sedimentary accommodation that became fundamental to models of sequence stratigraphy, 2) it also anticipates Ager's (1981, 1993) point that the sedimentary record is 'more gap than record;' and 3) it constitutes the first systematic exploration of the problem of preservation potential." [23]

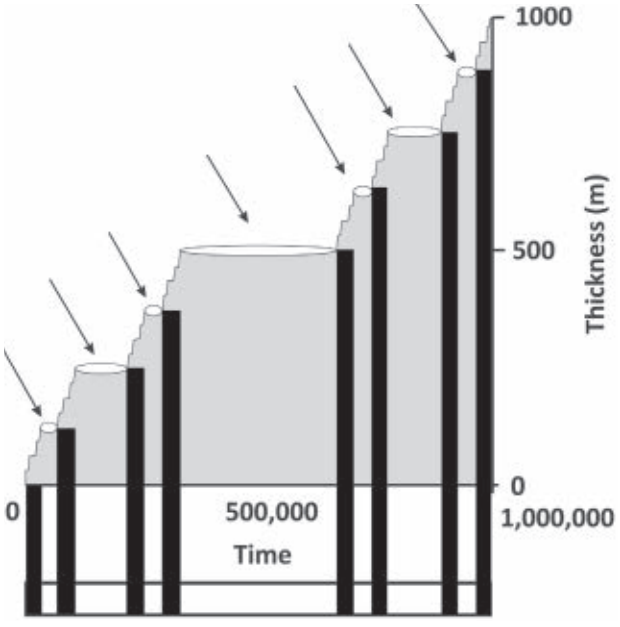

Figure 1. This 'devil's staircase' shows interaction between sedimentation, erosion, and accumulation for a hypothetical 1000-m stratum formed over one million years. It emphasizes the fractal nature of preservation, showing limited times of sediment accumulation (black vertical bars), interspersed with erosion and non-deposition (arrows = major hiatuses). When black bars are extended down (box at bottom), they form a Cantor bar showing sedimentation over time. (After Plotnick.[20])

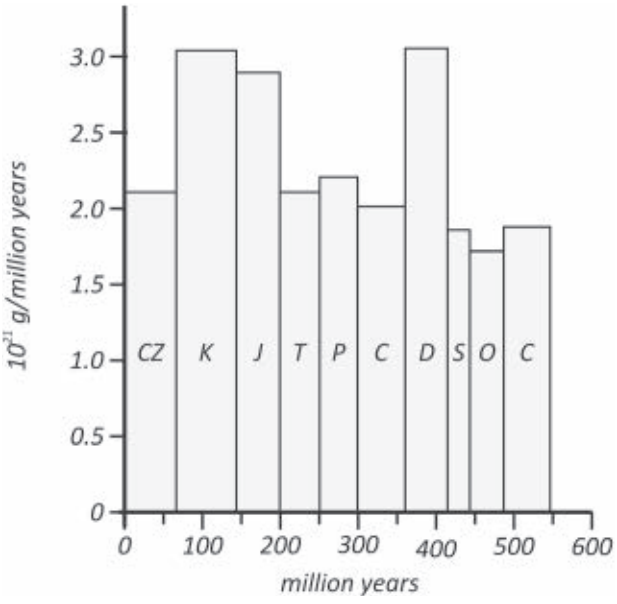

Figure 2. Mass of sedimentary rock on Earth by age. Modified from Ronov's figure 7,[28] this graph does not agree with the log-linear decrease in sedimentary rock accumulation over time predicted by sedimentation rate studies.

He sees a glimmer of a solution in Sadler's study, which compared 25,000 sediment accumulation rates and saw variation over 11 orders of magnitude in an apparent log-linear manner.[24] This means that sedimentation *rates* decrease back in time. He anticipated the fractal model of hiatuses when he noted that "the completeness of sedimentary sections can become very low if we concern ourselves with fine time scales".[25] Miall makes much of this mathematical relationship between stratal completeness and time to preserve uniformitarian stratigraphy:

> "Actual sedimentation rates in most geological settings are always likely to be much higher—typically orders of magnitude higher—than those calculated from the rock record, based on observable geological data, such as extrapolations from datable ash beds or biohorizons, or rates based on regional rates of accommodation generation. There is no conflict between the rapid sedimentation that can commonly be observed in modern settings, and the rates that prevailed in the past. Uniformitarianism is correct, but with the additional proviso that analyses of the past must take into account the ubiquitous hiatuses, many quite cryptic, that occur at all time scales."[26]

In other words, he predicts that accumulating erosion over time would disproportionately affect older strata, showing an artificially low apparent sedimentation rate.[8] Ronov noted this predicted decline:

> "The variations are evidently due to two factors: 1) differences in the rates of sedimentation during different stages of the Neogean (lower rates in the late Proterozoic interval); and 2) processes of erosion and weathering, which could have removed part of the original volume of the rocks. The scale of the loss may be judged solely by statistics, assuming that the older the sedimentary rocks, the greater the likelihood that they have been eroded. In that case, the relative mass of the sedimentary rocks should gradually decrease from younger to older. Gregor … recently came to that conclusion, followed by Garrels and Mackenzie … They established that the relative mass of sedimentary rocks should decrease according to an exponential law, from the present to the distant past."[27]

Six Conclusions of Bailey & Smith (2010)	
Quotes	**Implications**
Continuous deposition … has no theoretical or evidential basis … . It is fundamentally incompatible with the observable layering. Its use as a criterion for the selection of global stratotypes is … flawed.	Continuous sedimentation is a fundamental assumption of stratigraphic type sections, including GSSPs. Thus, the time scale is not anchored in the rock record, and global correlation is not possible via the sedimentary or derivative fossil records.
… the notion persists that at some scale of stratigraphic resolution, continuity in accumulation can be assumed … . This assumption may be operationally convenient, but it is unsupported.	Stratigraphic interpretation is scale dependent, and is subjective because continuity is assumed. It 'works', but has no basis. This may suggest that its utility relies more on a *priori* assumptions than on any strength of the method.
A record in which almost all the operations of the sedimentary system(s) are unrecorded, and in which hiatuses show fractal scale relationships … cannot be relied upon to preserve the sequential relationships on which … Walther's Law depends.	Walther's law of the vertical preservation of adjacent lateral facies requires preservation of these facies. If the record is mostly gaps, and gaps occur at all scales, we cannot know if or how vertically adjacent layers are related.
The power law decline in rates of accumulation with increase in the time span over which they are measured … means that the age of a stratigraphic datum cannot be interpolated using the net rate of accumulation of the interval in which it occurs … all net rates are unique to the interval for which they are estimated, precluding … extrapolation of process rates from one part of the record to another.	Stratigraphers have always used thickness of rock units as a surrogate for time. But this cannot be done because even the rates change over time, and the sparse nature of the record means we do not know how much of any unit has really been preserved. Present day rates are especially poor predictors of ancient strata.
… the record may not be representative of this history … any record represents some small, but essentially immeasurable, fraction of the time span … the other is that in many environments preservation of strata in the record … is very much the exception … atypical of their time, and hence not properly representative.	An axiom of historical geology is that rocks and fossils form coherent historical records sufficient to know the past. Because most time is missing, we cannot know the past. Environmental interpretation is equally flawed by the incomplete sample we possess.
… it is not possible to determine whether currently observable sedimentary processes - the basis of the uniformitarian axiom -are of the kind that will provide records in the future.	Uniformitarianism was saved by the recent emphasis on its use as method. This invalidates that method, leaving only a generic uniformity, and invalidating uniformitarian history.

Figure 3. Bailey and Smith's challenges to modern stratigraphy; their quotes to left, author's explanation to right. GSSP = Global boundary Stratigraphic Section and Point.[5]

But then he affirmed that the actual rock record showed otherwise (figure 2):

> "Using the method of the authors just mentioned, I constructed histograms, based on data in Table 7, in which are plotted the relative masses of the sedimentary rocks assigned to each period of the Phanerozoic per unit of time, that is, per million years … Contrary to expectation, *the graphs do not reveal a regular decrease in the relative masses of rocks with increasing time*; instead, they show periodic fluctuations [emphasis added]."[28]

Pessimistic conclusions of Bailey and Smith

Bailey and Smith followed the logic of a fractal sedimentary record to a series of conclusions that undermine traditional stratigraphy (figure 3).[7] The lack of rocks helps shed illusions regarding fundamental assumptions of historical geology. Miall summarized their points:

- The notion of continuous deposition, on which the historicity of the record depends, has no theoretical or evidential basis …
- If there is no continuity in accumulation, the sequential preservation of laterally contiguous facies, according to Walther's Law, becomes questionable.
- Stratigraphic hierarchies are constructs, commonly tailored to human-scale analysis of the fractal record. They are a practical, convenient, but incomplete representation of this record.

- Currently-observable sedimentary processes and facies underpin uniformitarian stratigraphic interpretations. Yet there is no way of determining whether a present day deposit will be preserved millions of years hence … Specifically, are the snapshot 'frozen accidents of preservation' representative?
- As Sadler (1999) has shown, local calculations of accumulation rate are time-scale dependent.[29]

Their conclusions are in line with Kravitz, who noted that "geologists' knowledge of the past is based on … assumptions … [and] *they are products of the geologists' imagination* [emphasis added]".[30] In other words, historical geology is not the empirical, inductive construct commonly perceived; it is one possible template supported by tenuous data. The template's apparent success is virtual, not real.

Miall's solution

To his credit, Miall does not dismiss Bailey and Smith. He correctly sees that "*These conclusions would appear to invalidate virtually the whole of the last two centuries of stratigraphic progress* [emphasis added]*!*"[29] His solution is novel; the problem is not the record's incompleteness but our failure to comprehend physical and temporal scale. He chooses Sadler over Ronov:

> "Sadler (1981) documented this in detail, using 25,000 records of accumulation rates. His synthesis showed that measured sedimentation rates vary by eleven orders of magnitude, from 10^{-4} to 10^{7} m/ka. This huge range of values reflects the increasing number and duration of intervals of non-deposition or erosion factored into the measurements as the length of the measured stratigraphic record increases. … Crowley (1984) determined by modeling experiments that as sedimentation rate decreases, the number of time lines preserved decreases exponentially, and the completeness of the record of depositional events decreases linearly. Low-magnitude depositional events are progressively eliminated from the record."[31]

Miall then builds his solution into a diagram of Sedimentation Rate Scales (SRS), which range from minutes to millions of years (figure 4). Thus, geologists only need analyze at the proper timescale for each kind of sedimentary product (figure 5):

> "Stratigraphic and sedimentologic studies ranging from the micro scale to the regional, and based on time scales ranging from the short-term … to the long-term … are best carried out at the appropriate *SRS*, much like photography uses lenses of different focal length, from macro to telephoto to wide-angle, to focus in on features at the desired scale."[32]

Miall then answers the six points of Bailey and Smith with six of his own, addressed in the following discussion.

Discussion

Bailey and Smith noted the fractal nature of the sedimentary record, with self-similarity between laminae and megaregional strata.[33] Miall embraces self-similarity of the record over a range of scales but subsumes the *physical* scale into the *time* scale (figure 4), even though the timescale is a human construct that assumes uniformitarianism. The different conclusions of Miall and Bailey and Smith suggest a Kuhnian clash between data and paradigm—Bailey and Smith want to test the paradigm; Miall wants to save it. Like many predecessors, he thinks this requires only tweaking the definition and method of uniformitarianism—a classic example of moving the goal posts.

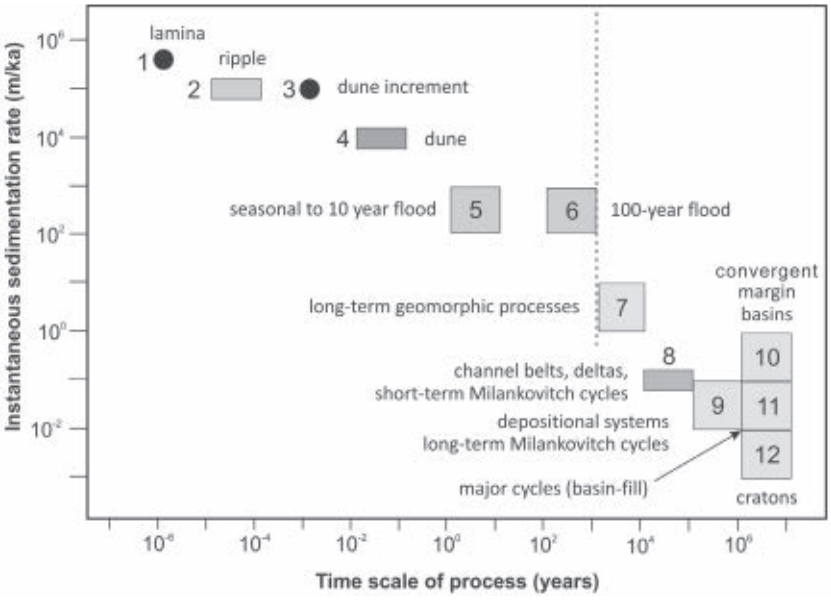

Figure 4. Miall's proposed Sedimentation Rate Scale, showing a range of 12 sedimentary processes, ranging from laminae to cratonic cover. Note that only the first six are open to observation. (After Miall's figure 3.[12])

Uniformitarianism more than a method

Ironically, his solution is all about perspective, yet limiting uniformitarianism to the actualistic method is a very one-dimensional view that avoids past problems of equivocation that began with Lyell's usurpation of Newtonian uniformity.

When Hooykaas[34] and Gould exposed it, geologists quickly redefined their problem away,[35] shuffling aside uncomfortable parts to accommodate neocatastrophism.[36] This reduced the problem from philosophy to methodology. Miall copies that approach when he says that "sedimentologists and stratigraphers have long had difficulty reconciling the concept of the *uniformity of processes* over time with the wide range of time scales and rates of processes over which sedimentation takes place [emphasis added]".[14]

But how can we frame the "range of time scales" or the "rates of processes" without first assuming a framework of history? How can we determine the "time scales" without prior knowledge of beginning and end, much less any points in between? How do we even know that time is linear?[37] Why rule out processes and rates which are foreign to modern observation or worse, downplay observed rates, as does Miall?

The real problem: the absence of evidence

Miall raises interesting points but fails to see the main problem of lack of evidence. He remains confident that stratigraphy and the rock record are both well grounded in reality, and that uniformitarianism is reliable. Thus, the problem cannot be objective failings of the fragmentary rock record, but the subjective failure of a proper perspective of those fragments. In Miall's thinking, when filtered by scale, stratigraphic history is just fine; its voluminous gaps are easily filled by interpolation. But he cannot escape the problem. Citing Ager, he says:

> "We talk about such obvious breaks [large unconformities], but there are also gaps on a much smaller scale, which may add up to vastly more unrecorded time. Every bedding plane is, in effect, an unconformity. It may seem paradoxical, but to me the gaps probably cover most of earth history, not the dirt that happened to accumulate in the moments between. It was during the breaks that most events probably occurred."[38]

The real problem is evidence and confidence. How much evidence is needed to provide a coherent story? Fifty percent? Ninety percent? Many scientists evaluate confidence with statistical error bars. But secular natural history as a whole seems immune from this kind of evaluation.

Worse, creationists and neocatastrophists note that the remaining 'dirt' was likely emplaced much faster than expected, and that remaining fragments are exaggerated during presentation. Reed[39] called this problem "scale masking". Using the Keweenawan basalts of the Midcontinent Rift System, which were likely each emplaced in hours, he extrapolated 194 such flows from the Texaco Poersch well in Kansas. Optimal coverage over the 21 Ma range would require equally spaced flows, shown as thin lines every 120,000 years (figure 6). More than 99% of the actual time is missing, and we cannot appreciate that percentage on a page-sized figure until we zoom down seven orders of magnitude (figure 6). Since it is unlikely that the flows were so conveniently equally spaced, the evidence in the record of that time is clearly diminished. If most were extruded during one event, the time between data points escalates to almost 21 Ma. That gap in time is a gap in our knowledge.

Miall also fails to see that naturalism requires empirical evidence. Creationists have a revelatory framework to support and constrain data.[40] Unaware of his own worldview, he sees the gaps as mere inconveniences. For example, the most important half of his 12 SRS classes cannot be observed, only inferred. Finally, evidence of catastrophic sedimentation exacerbates the evidentiary problem.

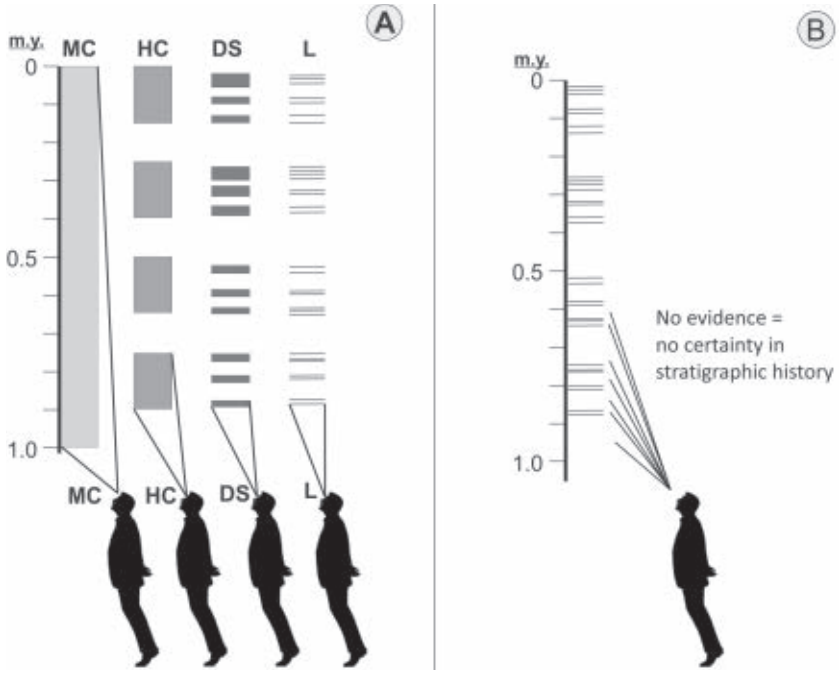

Figure 5. (A) Examination of the sedimentary record requires the proper scale to see missing section. A sedimentary cycle can be viewed on a million-year range (MC), which would record large regional unconformities. The same cycle can be viewed as a series of hundred-thousand-year cycles (HC) with several tectonic/eustatic unconformities, depositional systems (DS), or even lithosomes (L), such as individual channels or beaches. At finer scales, the greater amount of missing section is evident. But this shows (B) that actual sedimentary evidence for the million-year span is sparse, as Bailey and Smith noted. (After Miall's figure 2.[12])

Answers to Bailey and Smith

Miall addresses Bailey and Smith's conclusions (figure 7). Though not a direct point-by-point refutation, he advances six counter reasons for the traditional view. In essence, he is attempting to reconcile sedimentology and stratigraphy, and though he admits that sedimentology is problematic, he comes down on the side of stratigraphy. Close examination of his points reveals that they do not address root issues of Bailey and Smith.

Point 1. Lateral extent of sedimentary rocks explains lack of expected thickness

Bailey and Smith claim that continuous deposition is an illusion. Miall disagrees:

> "While accommodation is typically quantified in terms of vertical space relative to sea level … many important sedimentary processes are dominated by lateral sedimentary accretion."[26]

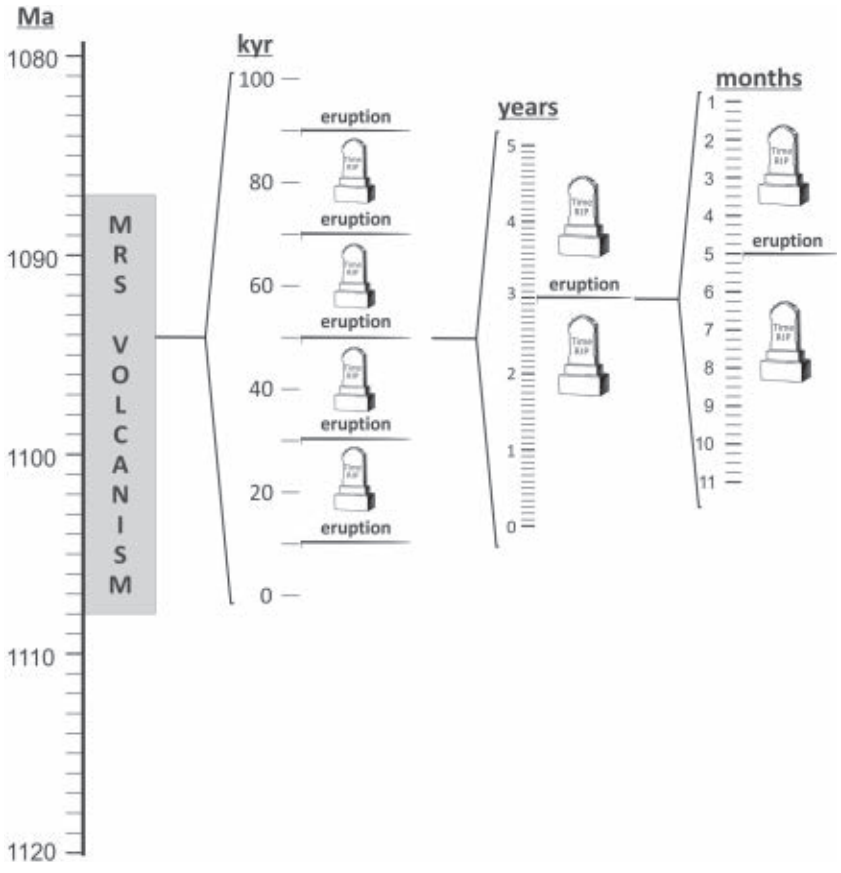

Figure 6. Keweenawan basalt flows at the Midcontinent Rift System demonstrate the problem of scale masking. Purported to have occurred in 21 Ma (1,108–1,087 Ma), the actual flows likely erupted in hours to days. Under Lake Superior, a flow happened on average every 10,000 years, representing 0.0008% of the time, while in Kansas a flow was emplaced every 120,000 years—0.00007% of the time. Both are vanishingly small fractions that cannot be accurately depicted on a typical figure, absent zooming in many times (right).

He implies that Bailey and Smith only analyzed sedimentary thickness rather than three-dimensional volume. While their Layer Thickness Inventory (LTI)[40] does evaluate two-dimensional well logs, all geologists use thickness as shorthand for volume. Ronov estimated the total volume of sedimentary rock on Earth but used average thickness as shorthand. Miall's answer is simply a diversion from the paucity of the rock record in *all* dimensions.

Actualism should be testable by comparing rock volume to observed sedimentation rates. Ronov's estimated total volume generates an average thickness of 2.2 km.[28] Sedimentation varies significantly, but modern rates are *much* higher, as Miall freely admits. If Earth is old, most of the stratal evidence is missing, both vertically and laterally. The typical answer that strata have eroded over time is an argument from a lack of evidence.

This inconsistency is significant because the volume of sedimentary rocks was an early, effective argument against the Flood.[41] Today it is an indictment of secular geology. Early uniformitarians argued that there are too many rocks, but today's uniformitarians do not seem to grasp the logical force of the contrary. Widespread rock bodies also argue for a diluvial explanation.[42]

Point 2. "Geomorphic time scale"[43] explains rapid sedimentation

Miall attempts to address the discrepancy between high modern rates and ancient preservation by finding exceptions to established stratigraphic dogma. Keep in mind that uniformitarians believe that accumulation rates are ultimately controlled by sea level and tectonism. His first exception is the possibility of local high rates sustained by local factors for short periods of time (figure 4):

> "Fluvial, tidal, and other channels, and valleys, ranging up in scale to major incised valley systems, are locations where accommodation is not controlled by base level but are best understood with reference to the buffer concept of Holbrook *et al.* (2006). Accommodation generation on geomorphic time scales is therefore not dependent on tectonic subsidence rates and may be substantially higher."[26]

Uniformitarians see accommodation space, generated by eustasy or tectonism, as the primary control of sedimentation. A gallon of milk poured into a glass will only yield the glass's volume. Likewise, excess sediment is not preserved. Estimated past rates of sea level change or tectonism can also be at odds with observed sedimentation rates.

This is important for diluvialists. Sedimentation controlled by accommodation space generated slowly by eustasy or tectonism is contrary to the Flood, because both were in disequilibrium. Thus, it was not such a limiting factor in the Flood. This fundamental difference needs to be explored by diluvialists.

Point 3. Deposition in some areas not restricted by periodicity of sea level changes

Miall looks for similar exceptions to established stratigraphic dogma in other environments:

> "In two other major settings, accommodation is not restricted by base level: Deposition landward of the shoreline and in inland nonmarine basins is constrained by depositional slopes that are dependent on upstream controls, such as rates of tectonic uplift, river discharge, and sediment load … Also, deep marine sediments are not in any way constrained by rates of accommodation generation, but are largely dependent on sediment supply."[26]

While true, the wholesale applicability of such environments to the rock record is the question. If hiatuses are less likely in deep marine deposition, many such sediments would still be absent via subduction. Thus, many of history's deep marine deposits should not exist. Although buffering can allow local high gradients and rapid sedimentation, sea level is the ultimate base level and control over sedimentation. Uniformitarians appeal to 'frozen accidents' of preservation in exceptional environments, even though they are subject to more active tectonism. Hence preservation would be a happy accident indeed, and these environments would be poor reflectors of orbital forcing, or of Earth history in general.

Point 4. Inherent order in sedimentation rates makes fragmentary rock record a 'time' record

Bailey and Smith noted that random low preservation of strata makes application of Walther's law of facies problematic. If a sequence of a marine transgressive sand overlies a deltaic mud, does it follow that the ocean into which the delta prograded was the same, responsible for the transgressive sand? Given a sufficient time gap, any activity could have occurred and had all evidence eroded. Miall rejects that conclusion:

> "Allogenic and autogenic sedimentary processes may generate predictable, ordered stratigraphic patterns at all time scales. The order and predictability may include erosional processes as well as processes of accumulation. This has always been the basis for Walther's Law … Therefore, contrary to the random or chaotic processes accumulation implied by Bailey and Smith (2010), stratigraphic order … may be preserved in the rock record."[26]

Miall plays off a cognitive dissonance in uniformitarianism—strata appear to show pattern and continuity yet are 'frozen accidents'. In this case, he focuses on the former, and says predictable patterns exist. But if hiatuses exist at all scales in a very scant record, how much of perceived order is subjective? He trusts his eyes; Bailey and Smith trust reason. Is stratigraphic interpretation 'exegesis' or 'eisegesis'? Zeller[44] demonstrated the role of human bias towards order and pattern based on discrepant correlations of the same sections by different geologists. They complained that they had been fooled, to which Zeller replied:

> "From the preceding story, it will be seen that our stratigraphic section, composed of randomly selected lithologies, does indeed show most of the characteristics that can be expected in a truly cyclic sequence. At this point the reader may wish to complain that the writer has gone too far in making up samples with which to taunt his

Bailey & Smith (2010)	Miall (2012)
Continuous deposition has no theoretical or evidential basis. Global stratotypes etc. are fundamentally flawed.	Accommodation measured vertically; most sedimentary processes are by lateral accretion.
Continuity is scale-related. Stratigraphic hierarchies are constructs, no basis in reality.	Channels - incised valleys not controlled by base level. On geomorphic time scales, accommodation independent of tectonic subsidence rates.
Impossible to know if present processes are representative of past (actualism).	Accommodation not controlled by base level also landward of shorelines and in inland basins. Depend on upstream controls like slope, uplift, discharge, and sediment supply.
Since almost all sedimentation is unrecorded and hiatuses are fractal, no basis for Walther's Law.	Sedimentary processes generate predictable, ordered patterns at all time scales. Order and cyclicity thus preserved, contrary to Bailey and Smith.
Net accumulation rates are scale-dependent and local. Cannot calculate process rates or relate rates from one area to another.	Sedimentary systems preserve more time in 3-D than local parts indicate. Continuous sedimentation occurs, just distributed across system (e.g., river, delta, shoreline).
Stratigraphic record fundamentally unrepresentative of geologic past.	Depositional rates much higher than those in rock record, but hiatuses at all scales are reason. Thus no conflict between two, and uniformitarianism is valid.

Figure 7. Comparison of the conclusions of Miall and Bailey & Smith

colleagues. Let the reader be assured, however, that the writer's humble efforts at creating confusion are of truly minute proportions when compared to those of nature."[45]

Miall believes that order in the record comes into focus at the proper scale. But if strata include significant missing sections at *every* scale, then the real sequence of processes cannot be known, and his SRS would be circular. On the other hand, real order and pattern in strata over large areas suggest a different paradigm is needed—like the Flood.

Point 5. 'Rock' record is representative at the right scale

Miall tries to square the two assertions that the rock record is fragmentary yet still yields scientific certainty:

> "Although sediment preservation is extremely discontinuous and spasmodic at any one location, the shifting locus of accumulation … means that substantially more elapsed time is represented by preserved sediment in three dimensions than the percentages relating to vertical accumulation noted earlier in this paper. At intermediate time scales (*SRS* 5-8) … sedimentation is continuous for lengthy periods of time, but distributed across an entire depositional system. Our tools for reconstructing these processes in the ancient record are quite limited."[26]

Miall must resort to the fundamental presupposition of global correlation. A layer absent in China is 'covered' by a correlative layer in Canada. This is the basis for all indirect correlation.[46] Note that correlation done by time—an intangible factor—overrides physical evidence: lithology, fossils, isotopic ratios, magnetic stripes, or astronomical cycles. These are only tools to apply a specific time signature to rock bodies, but it is the time that is correlated, not the forensic data. Early stratigraphers could not know if rocks were globally correlative, but assumed so, stretching Steno's original continuity to the breaking point. Overconfidence in this flawed approach is seen in the requirement for only one GSSP per stage for the entire planet.

Miall fudges the physical with the temporal here too. Because strata are part of larger depositional systems, parts that are missing at Point A are assumed to be present elsewhere. We intuit a river from a delta. But if strata are 'frozen accidents', then how can we confidently connect strata that are not physically linked? And does the presence of undetected fractal hiatuses throughout the section throw those apparent links into question? Miall believes that lateral shifts of sedimentary processes capture *time*, even if time captures little *rock*. But this assumes we understand the processes enough to fill in the gaps. Bailey and Smith fear the gaps are less friendly.

Point 6. Apparent conflict between observed rapid sedimentation and inferred slow past rates is a function of decreasing preservation

To preserve uniformitarianism, Miall must find a way to address higher observed rates today with lower inferred rates of the past:

> "Actual sedimentation rates in most geological settings are always likely to be much higher … than those calculated from the rock record, based on observable geological data, such as extrapolations from datable ash beds or biohorizons, or rates based on regional rates of accommodation generation. There is no conflict between the rapid sedimentation that can commonly be observed in modern settings, and the rates that prevailed in the past. Uniformitarianism is correct, but with the additional proviso that analyses of the past must take into account the ubiquitous hiatuses, many quite cryptic, that occur at all time scales."[26]

Miall is attempting to use a significant problem—fractal hiatuses—to solve that of conflicting rates. But his 'new' uniformitarianism contradicts the 'old' uniformitarianism that comprises his foundation. Geology supposedly rejected the Flood in favour of actualism. Now, it turns out that the

	Uniformitarian Framework	Diluvial Framework
Sedimentary Processes	Actualism requires them to be those observed today. Changes in preservation explain discrepancies between modern sediments and those in the rock record.	Empirically determined. Constrained in part by hydrodynamic and sedimentologic physics, but large scale changes may yield qualitative changes too.
Accommodation: Sea Level Change	Sea level changes slowly in response to climate and plate tectonics. Sediment is produced in excess, only preserved when space is available, e.g., a transgression.	Sea level changes rapidly and dynamically, creating large accommodation space. Especially true in early Flood's global, energetic transgression.
Accommodation: Tectonic Processes	Tectonic basins are created very slowly, and capture only a small % of total sediment produced. Preserved in basins over 10^5 to 10^7 time scale.	Rapid tectonism creates basins at every terrestrial scale; preservation is more complete due to rapid formation and burial.
Preservation Potential	Only small fraction of sediment is ever preserved. Hiatuses at all scales. However, analysis of present processes encourages assumptions of continuity and correlation.	Potential large, especially early in Flood. Rapid accommodation generation and rapid burial yield WYSIWYG strata. Hydrodynamic hiatuses may represent no time.
Geomorphic Setting	Major control of sedimentation; in turn it is controlled by climate and tectonics.	Factor both early and late in Flood; landscape less relevant in marine setting; late Flood creates modern landscape at a variety of scales.

Figure 8. Diluvialism provides alternative and innovative answers. One of the most important is that diluvialists expect greater preservation—a 'what you see is what you get' (WYSIWYG) approach, rather than the 'frozen accidents' of uniformitarianism.

concept is more malleable. Why is it acceptable to intuit *lower* past rates, but not *higher* ones?

Furthermore, if present rates cannot be trusted, then why should any uniformitarianism be trusted? Either the present is representative or it is not. Empiricism requires following the data. If the data suggest that the record is too incomplete, then the data should be honoured. Note also the use of "cryptic hiatuses" as a licence to insert a gap wherever needed.

A diluvial alternative

The years have been hard on Lyell's pristine positivism, and uniformitarian geology seems to always shoot itself in the foot. The logical incompleteness of the stratigraphic record illustrates inconsistency between their assumptions and the rocks. Either actualism does not work, billions of years are not really there, the record is not representative, or all three are true. Miall thinks a scale qualifier will solve the problem, but the ultimate incoherence of uniformitarianism transcends his classification system. Another possibility is that a new framework is needed. If history is an unbiased forensic exercise, then alternative paradigms should be welcome.

Diluvial geology has answers for Miall's problems. Sedimentary processes, accommodation space, preservation, completeness, and even geomorphology all have distinct starting points that are worth trying (figure 8).

Conclusion

For more than half a century, geologists have been struggling to define their fundamental principle, but without success.[15] One of the outgrowths of their dalliance with neocatastrophism was an examination of the incompleteness of the sedimentary record. Bailey and Smith followed that logic to a pessimistic conclusion that threatened the foundations of stratigraphy. Miall, in an attempt to absorb neocatastrophism into uniformitarianism, and rescue traditional stratigraphy, proposes another tweak to the ever-malleable definition of uniformitarianism. He thus allows a sliding scale of sedimentary processes to account for any number of rates to cover discrepancies between uniformitarian theory and field examples of rapid rates. Even apart from past equivocation of 'uniformitarianism', Miall faces an uphill battle. Like Lyell, he tries to mask a philosophy of history by presenting it as a forensic method. But he cannot reconcile the unintended consequence of fractal hiatuses, 'frozen accidents', deep time, and actualism. Secular natural history fails all by itself because its only acceptable past evidence is largely gone. Diluvialists are not so constrained by a rigid empiricism, have a pattern for the rock record in the Flood, and are more optimistic about preservation.

Glossary

Actualism. A fundamental axiom of method in historical geology that restricts potential interpretations of the rock record to the limited reservoir of observed modern examples.[15]

Facies. A means to classify rocks according to their physical characteristics rather than their age.

Geomorphology. The earth science discipline that addresses the description and interpretation of landforms.

Methodological uniformitarianism. When it had become clear that the term 'uniformitarianism' was equivocal, geologists in the 1960s and 1970s proposed four distinct definitions for the term.[15] Methodological uniformitarianism, proposed by Gould in 1965, is the most common use today, and is virtually synonymous with actualism.

Neocatastrophism. A school of geology growing out of the 1970s and 1980s that emphasized the (naturalistic) role of catastrophic processes in the past, such as impact events. It is associated in stratigraphy with the work of British geologist Derek Ager.

Positivism. The epistemological commitment to science as the arbiter of truth.

Sedimentology. The study of sediments and sedimentary rocks, including their description and origin.

Stratigraphy. The discipline of geology that orders rock strata according to age; it includes the various methods by which such determinations are made (e.g. biostratigraphy, cyclostratigraphy). The ultimate product of stratigraphy is the geological time scale.

Sequence stratigraphy. A branch of stratigraphy developing in the mid-20th century that emphasized the fine discrimination of sedimentary 'sequences', often using seismic data, and arranged them according to sea level changes over time.

Walther's law. Any vertical stratigraphic linking of ancient facies must be restricted to those observed laterally adjacent to each other in the present. E.g. it is a reasonable interpretation that deltaic facies are vertically overlain by transgressive marine sands.

References

1. Reed, J.K. and Williams, E.L., Battlegrounds of natural history, part II: actualism, CRSQ **49**(2):135–152, 2012.
2. Gould, S.J., Is uniformitarianism necessary? *American J. Science* **263**:223–228, 1965; Gould, S.J., Catastrophes and steady state earth, *Natural History* **84**(2):15–18, 1975; Gould, S.J., Toward the vindication of punctuational change in catastrophes and earth history; in: Berggren, W.A. and Van Couvering, J.A. (Eds.), *Catastrophes and Earth History*, Princeton University Press, Princeton, NJ, pp. 9–34, 1984.
3. Hooykaas, R., *The Principle of Uniformity in Geology, Biology, and Theology*, 2nd impression, E.J. Brill, London, 1963.
4. Ager, D.V., *The Nature of the Stratigraphical Record,* John Wiley and Sons, New York, 1973; Baker, V.R., Catastrophism and uniformitarianism: logical roots and current relevance in geology; in: Blundell, D.J. and Scott, A.C. (Eds.), *Lyell: the Past is the Key to the Present*, Special Publication 143, Geological Society, London, pp. 171–182, 1998.

5. Reed, J.K., Toppling the timescale, part III: madness in the methods, CRSQ **45**(1):6–17, 2008.
6. Reed, J.K., Toppling the timescale, part IV: assaying the golden (FeS2) spikes, CRSQ **45**(2):81–89, 2008.
7. Bailey, R.J. and Smith, D.G., Scaling in stratigraphic data series: implications for practical stratigraphy, *First Break* **10**:57–66, 2010.
8. Reed, J.K. and Oard, M.J., Not enough rocks: the sedimentary record and Earth's past, *J. Creation* **31**(2):84–93, 2017.
9. Reed, J.K., Changing paradigms in stratigraphy—"a quite different way of analyzing the record", *J. Creation* **30**(1):83–88, 2016.
10. Philosopher of science Gadi Kravitz admitted that, "the geologists' knowledge of the past is based on pretheoretical assumptions, often of a metaphysical nature, not susceptible to logical or empirical proof. In a certain sense, *they are the products of the geologists' imagination* [emphasis added]". Kravitz, G., The thermodynamics time arrow and the logical function of the uniformity principle in geohistorical explanation; in: Baker, V.R. (Ed.), *Rethinking the Fabric of Geology*, Geological Society of America Special Paper 502, Boulder, CO, p. 21, 2013.
11. Miall, A.D. and Miall, C.E., Empiricism and model-building in stratigraphy: around the hermeneutic circle in the pursuit of stratigraphic correlation, *Stratigraphy* **1**(1):27–46, 2004.
12. Miall, A.D., A new uniformitarianism: stratigraphy as just a set of 'frozen accidents'; in: Smith, D.G., Bailey, R.J., Burgess, P.M., and Frasier, A.J. (Eds.), *Strata and Time: Probing the gaps in our understanding*, Special Publication 404, Geological Society, London, pp. 11–36, 2015; p. 31.
13. Challinor, J., Uniformitarianism—the fundamental principle of geology, *XXIII International Geological Congress* **13**:331–343, 1968.
14. Miall, ref. 12, p. 11.
15. Reed, J.K., *Rocks Aren't Clocks*, Creation Book Publishers, Powder Springs, GA, 2013.
16. Cf. Reed, J.K., Untangling uniformitarianism, level I: a quest for clarity, *Answers Research J.* **3**:37–59, 2010; and Reed, J.K., Untangling uniformitarianism, level II: actualism in crisis, *Answers Research J.* **4**:203–215, 2011.
17. Miall, A.D., Sophisticated stratigraphy; in: Bickford, M.E. (Ed.), *The Web of Geological Sciences: Advances, impacts, and interactions*, Geological Society of America Special Paper 500, Boulder, CO, pp. 169–190, 2013; p. 184.
18. Mandelbrot, B.B., *The Fractal Geometry of Nature: Updated and augmented*, W.H. Freeman and Company, New York, 1983.
19. E.g. Middleton, G.V., Plotnick, R.E., and Rubin, D.M., *Nonlinear Dynamics and Fractals: New numerical techniques for sedimentary data*, SEPM Short Course 36, Tulsa, OK, 1995.
20. Plotnick, R.E., A fractal model for the distribution of stratigraphic hiatuses, *J. Geology* **94**(6):885–890, 1986.
21. Plotnick, ref. 20, p. 888.
22. Miall, A.D., *The Geology of Stratigraphic Sequences*, 2nd edn, Springer, New York, 2010. See especially his chapter 13, Time in sequence stratigraphy.
23. Miall, ref. 12, pp. 11–12.
24. Sadler, P.M., Sediment accumulation rates and the completeness of stratigraphic sections, *J. Geology* **89**:569–584, 1981.
25. Sadler, ref. 24, p. 579.
26. Miall, ref. 12, p. 25.
27. Ronov, A.B., *The Earth's Sedimentary Shell*, American Geological Institute Reprint Series 5, Falls Church, VA, p. 12, 1983.
28. Ronov, ref. 27, p. 13.
29. Miall, ref. 12, p. 13.
30. Kravitz, G., The thermodynamics time arrow and the logical function of the uniformity principle in geohistorical explanation; in: Baker, V.R. (Ed.), *Rethinking the Fabric of Geology*, Geological Society of America Special Paper 502, Boulder, CO, pp. 19–40, 2013; p. 21.
31. Miall, ref. 12, pp. 12–13.
32. Miall, ref. 12, p. 14.
33. Cf. Bailey and Smith, ref. 7, figure 2.
34. Hooykaas, R., *The Principle of Uniformity in Geology, Biology, and Theology*, 2nd impression, E.J. Brill, London, 1963; and Hooykaas, R., Catastrophism in geology: Its scientific character in relation to actualism and uniformitarianism, *Mededelingen der Koninklijke Nederlandse Akademic van Wetenschappen* **33**:271–316, 1970.
35. Rudwick, M.J.S., Uniformity and progression: reflections on the structure of geological theory in the age of Lyell; in: Roller, D.H.D. (Ed.), *Perspectives in the History of Science and Technology*, University of Oklahoma Press, Norman, OK, pp. 209–237, 1971.
36. Cf. Bates, R.L. and Jackson, J.A. (Eds.), *Glossary of geology*, American Geological Institute, Alexandria, Virginia, 1987; vs Neuendorf, K.K.E, Mehl Jr, J.P., and Jackson, J.A., (Eds.), *Glossary of Geology,* 5th edn, American Geological Institute, Alexandria, VA, 2005.
37. Reed, J.K. and Klevberg, P., Battlegrounds of Natural History, part III: historicism, CRSQ **51**(4):177–185, 2015.
38. Ager, D.V., *The New Catastrophism*, Cambridge University Press, Cambridge, UK, p. 14, 1993; quoted in Miall, ref. 12, p. 12.
39. Reed, J.K., *The North American Midcontinent Rift System*, Creation Research Society Books, Chino Valley, AZ, p. 114, 2000.
40. See Bailey and Smith, ref. 7 for explanation.
41. Reed, J.K. and Oard, M.J., Three early arguments for deep time, part III: the sedimentary record, *J. Creation* **26**(2):100–109, 2012.
42. Oard, M.J., Defining the Flood/post-Flood boundary in sedimentary rocks, *J. Creation* **21**(1):98–110, 2007.
43. 'Geomorphic timescale' is Miall's term for a relatively short period of time in uniformitarian scale, thousands to tens of thousands of years. See figure 4.
44. Zeller, E.J., Cycles and psychology, *Kansas Geological Survey Bulletin* **169**:631–636, 1964, kgs.ku.edu/Publications/Bulletins/169/Zeller/index.html.
45. Zeller, ref. 44, p. 635.
46. Reed, J.K., Toppling the timescale, part II: unearthing the cornerstone, CRSQ **44**(4):256–263, 2008.

John K. Reed *earned B.S., M.S., and Ph.D. degrees in geology. He worked for several decades as a professional geologist in industry and academia. In 1998, John became the geology editor of the Creation Research Society Quarterly, and was subsequently elected to the CRS Board of Directors. He has written and edited numerous books and articles about creation and natural history.*

The Flood/post-Flood boundary along the Arctic coast of North America

Michael J. Oard

It is important to find the correct location of the Flood/post-Flood boundary. The Arctic coastal area is a difficult place to determine this boundary because its unique environment complicates the research. The Pliocene epoch appears to have been much warmer in the Arctic. This supports creationist predictions, while the uniformitarian model fails to predict the warmth. Most geological features indicate the strata in the Arctic coastal region are Flood sediments, with the Flood/post-Flood boundary above the Pliocene. Along the northern slope of Alaska, the Sagavanirktok Formation is also indicative of Flood sedimentary rock, but the overlying Pliocene Gubik Formation along the coast is most likely post-Flood. Thus, the boundary here is likely between the Miocene and Pliocene. This research has implications for uniformitarian dating methods, the biblical history of the Arctic, and the post-Flood Bering Land Bridge.

Since the Flood/post-Flood boundary remains controversial, I have developed 32 criteria for determining its position in the geological column.[1] These criteria span most subfields of geology. They include seven factors within sedimentary rocks,[2] seven from organic remains,[3] five tectonic factors,[4] eight evidences from geomorphology,[5] and others. I concluded the boundary is primarily in the late Cenozoic, defined as the Miocene, Pliocene, Pleistocene, and Holocene (the latter two comprising the Quaternary) using the geological column as a reference point. Figure 1 displays the geological column from the Archean to the present with the Cenozoic period subdivided into epochs. Uniformitarian dating problems keep us from assigning a precise location on the geological column or definitively stating the Pliocene/Pleistocene is the Flood/post-Flood boundary (see below). Each geographic location must be evaluated on its own merits. For instance, Pliocene and early Pleistocene mammal fossils entombed on the High Plains of the United States would be from the Flood,[6,7] while marsupial fossils from Australia, mostly dated to as old as Miocene,[8] could easily be post-Flood.

The Flood/post-Flood boundary along the Arctic coast

We now turn to the Arctic coast of North America, because of its unique location in respect to its inaccessibility. Arctic geology is confounded by stratigraphic problems, different names of formations in different areas, changing ages for strata, changing dates for epoch boundaries, claims of reworking, and occasional unique fossil finds. Moreover, the observations are isolated and uniformitarian and evolutionary assumptions and interpretations bias their conclusions. All of this makes it challenging for the biblical geologist to determine precisely the Flood/post-Flood boundary along the Arctic coast, so any current results remain tentative.

Biblical geology predicts finding fossil evidence for a warm pre-Flood climate buried in the Flood. At high latitudes near the pole, during the Flood nearby 'warm-climate' pre-Flood vegetation could have been buried or low-latitude vegetation transported to higher latitudes. A warm climate at high latitudes early in the post-Flood Ice Age is also predicted because the Arctic Ocean was warm after the Flood. During the Flood the ocean water was warmed by extensive volcanism, possible impacts, and other possible processes that operated during the Flood. The warmer ocean also caused the atmospheric temperatures to be warmer at high latitudes, greatly increasing the precipitation in the region. In fact, these conditions set the stage for the Ice Age.[9] The likelihood that the climate was warm during and immediately after the Flood makes the Flood/post-Flood boundary more challenging to decide, especially if we base the determination on the character of the fossils.

General geology

For determining the Flood/post-Flood boundary, I will only consider options from the Cretaceous/Paleogene (K/Pg) boundary and above. Lower boundaries make little sense in a Flood model,[10] and are rejected by most creation scientists.

It appears the rocks in the Arctic represent all geological periods,[11] but the Cenozoic mainly outcrops near the Arctic Ocean. It is in this area that the location of the Flood/post-Flood boundary is the most difficult to determine.

The top sediments and sedimentary rocks along the north slope of Alaska (figure 2) are mostly dated as Cenozoic.

They consist mainly of the Sagavanirktok Formation, named after the Sagavanirktok River which flows into the Arctic Ocean, and the Gubik Formation along the Arctic coast that immediately overlies the Sagavanirktok Formation.

Along the north-west coastal plain of the Queen Elizabeth Islands between 72 and 80°N, the Beaufort Formation is the main exposed formation. It stretches 1,200 km long and is about 50 km wide from Banks Island north-east to Meighen Island (figure 3). Some geologists extend the Beaufort Formation eastward to include isolated strata on Axel Heiberg and Ellesmere Islands. Below these Cenozoic strata are the upper Mesozoic and lower Cenozoic Eureka Sound Group.

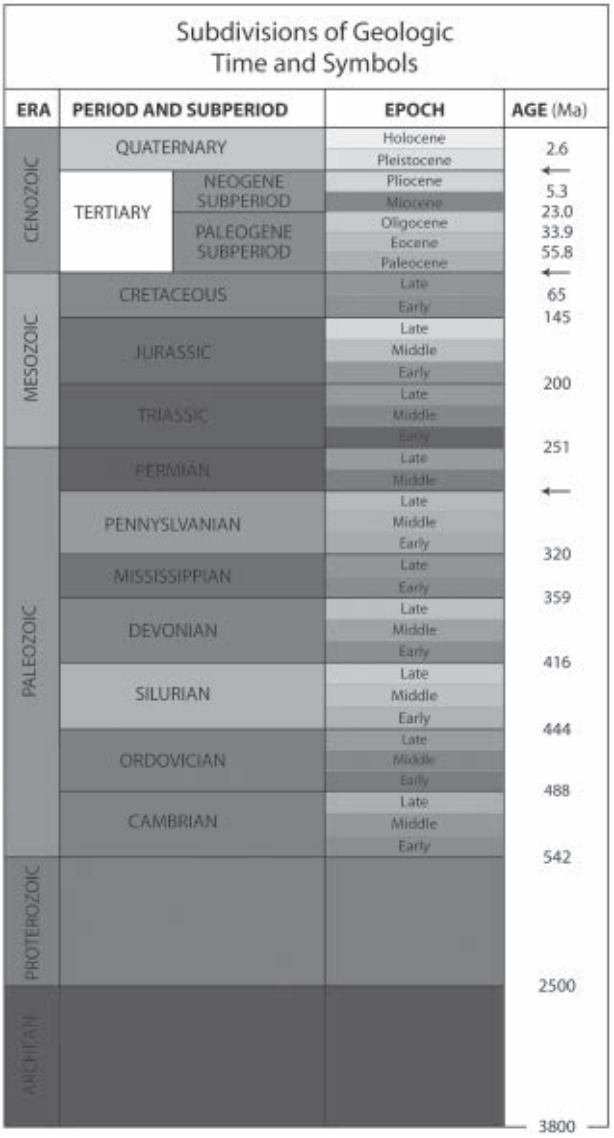

Figure 1. The geological column and timescale from the late Archean until the present showing the eras, periods, sub-periods, and epochs of evolutionary/uniformitarian earth history. The ages in millions of years are shown on the right. The horizontal arrows on the right show the three main locations for the Flood/post-Flood boundary believed by creationists.

Pliocene warmth—a major uniformitarian problem

The Pliocene epoch, conventionally dated as 5.33–2.58 Ma (figure 1), just before the uniformitarian Ice Age period, is interpreted to have been warmer and wetter than today,[12] though not nearly as warm as the early Tertiary (see below). In fact, some scientists use the Pliocene as a proxy for future global warming. Global temperatures are said to have been 2–4°C warmer in the Late Pliocene just before the ice ages.[13] Temperatures were even warmer in the Arctic. Ellesmere Island was 11–16°C warmer,[14] and the Canadian High Arctic was 19°C warmer.[15] Precipitation is thought to have been three times that of today, at least in north-east Siberia.[16] New proxy estimates continue to raise the temperature difference between the Pliocene and today.[17] Sea level is believed to have been 35 m higher than it is today[18] and sea surface temperatures in the Arctic 6–10°C warmer,[19] essentially eliminating sea ice. Moreover, permafrost was thought to be patchy[16,20] and forests extended northward to the Arctic Ocean, including northern Greenland[21] and northern Siberia.[22]

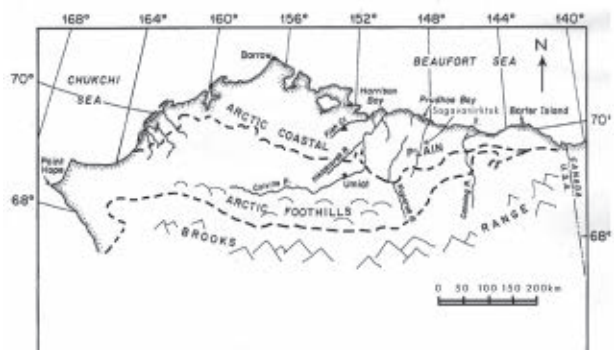

Figure 2. Map of northern Alaska (drawn by Melanie Richard). The Gubik Formation, not marked, outcrops close to the Arctic coast.

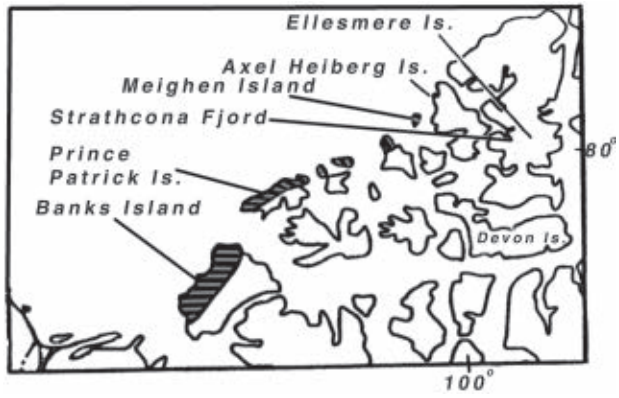

Figure 3. Map of Queen Elizabeth Islands showing the Beaufort Formation (drawn by Melanie Richard). Note that the Beaufort Formation is marked in the figure as a shaded/horizontal strip area.

Uniformitarian simulations do not explain Pliocene climate

Uniformitarian scientists have modelled Pliocene climates but have run into great difficulties. Problems arose primarily because they assumed external factors, such as geography and atmospheric carbon dioxide, were about the same as today.[12,23] To try and make the simulation work, they *force fitted* warm temperatures by prescribing initial and boundary conditions. For instance, they prescribed constantly warm sea surface temperatures at high latitudes, and stronger north-south winds transporting warm air north. However, these initial conditions were quite artificial.

Interestingly, though, the constantly warm sea surface temperatures allay the uniformitarian difficulties only a little.[24] One problem with warm air being transported to high latitudes is that the amount transported is directly proportional to the north-south temperature gradient. Tropical temperatures are believed to be about the same as today or a few degrees warmer.[25,26] With much warmer polar temperatures, the gradient was greatly reduced in the Pliocene. So, northward transport of warmer air should have been reduced, not enhanced.

The boundary is above the Eureka Sound Group, Queen Elizabeth Islands

The Eureka Sound Group in north-west Canada is dated as Cretaceous and early Tertiary, and is up to 4,000 m thick.[27] It forms the top strata of the 13-km-thick sequence in the Sverdrup Basin that covers most of the Queen Elizabeth Islands.[28] Coal is abundant in the group and the Eureka Sound Group shows strong evidence for uniformity over a vast area:

> "Everywhere that the Eureka Sound Formation or its direct correlatives are present, there is a predominance of clastic sedimentary rocks with locally abundant coal. This is strong evidence for virtual uniformity of depositional conditions over roughly 2,000,000 square kilometres encompassing a broadly triangular area from north-eastern Ellesmere Island to Banks Island to northern Baffin Island."[29]

Fossils found in the Eureka Sound Group—e.g. lemurs, alligators, turtles, and swamp cypress—indicate the paleoclimate ranged from tropical to warm temperate with little seasonal contrast (equable).[30,31] The average temperature is claimed to have been 35°C warmer (going from today's average of –20°C to 15°C) in the Eocene Arctic than it is today.[14] This is probably an underestimate, since subtropical to tropical fossils imply an even warmer climate than 15°C. Temperatures with little seasonal contrast and a lack of sunlight for months seem impossible after the Flood.

The isolated outcrops of the 'Beaufort Formation' were claimed to be solidly dated by fossils,[31] but some of these outcrops are now considered to be part of the Eureka Sound Group.[32] The assignment to the Beaufort Formation was "in keeping with the general use of Beaufort Formation for Neogene sediments in the Canadian Arctic Archipelago".[33] In other words, the date and formation simply filled a time slot based on fossils and the inferred climate.

There has been a large amount of literature about the vertical trees found in multiple coal seams in the Geodetic Hills of eastern Axel Heiberg Island.[34] Several features of this site, such as unfossilized trees and leaf litters, would suggest a post-Flood climate around a warm ocean early in the Ice Age. But, an analysis of the extensive data indicates that the Axel Heiberg site, as well as other locations on Ellesmere Island, are deposits from the Flood.[35,36] The leaf litter was no more decayed at its base than at its top, making deposition after the Flood unlikely.[37] A previously formed *in situ* soil profile would contain much decayed plant matter with depth, which is not apparent here. So, the leaf litters are not associated with soils for the trees. The huge extent, uniformity, depth in kilometres, warm-climate fossils, and the existence of coal all strongly point to the Eureka Sound Group being Flood strata.[1] The vertical trees and coal with the transport of warm climate plants and animals can be explained by the creation log mat model.[38] This would place the Flood/post-Flood boundary in the upper Cenozoic in this location.

The Flood/post-Flood boundary is probably on top of the Beaufort Formation

This places the Flood/post-Flood boundary in Arctic Canada at the base, within, or at the top of the Beaufort Formation, which outcrops along the coastal plain of the Queen Elizabeth Islands (figure 3). Since this determination is difficult, I will first examine the 'type site' for the formation on Prince Patrick Island. The island has the advantage of never having been glaciated, since no glacial till has been found there. It was unglaciated, like other islands and parts of islands in northern Canada, because of the warm Arctic Ocean in the biblical Ice Age model.

Prince Patrick Island type site

The Beaufort Formation on Prince Patrick Island is an unconsolidated wedge of mostly sand that thickens seaward toward the north-west. It is similar to the Beaufort Formation on other islands, where it is capped by glacial debris.[39,40] Although outcrops are rather isolated in the central part of the Prince Patrick Island, on the large scale of the Queen Elizabeth Islands the formation is generally uniform. The formation lies on a variety of rocks identified as Paleozoic to early Cenozoic. It is generally horizontal and thickens north-west to possibly 600 m on the north-west coast, and

presumably continues to thicken offshore. The Beaufort Formation is covered near the coast, so the thicknesses are an estimate.

There are rapid changes in sediment type (facies changes) on a scale of 5–50 m between all kinds of different sediment from clay to gravel, suggesting a 'braided river' uniformitarian depositional model. There is an abundant amount of fresh-looking, water-worn, unfossilized wood lacking bark from mostly coniferous forests. The gravel is mostly rounded to subrounded, resistant lithologies, and paleocurrent directions are toward the west to north-west, i.e. toward the Arctic Ocean. Coal, amber, and pollen are believed to have been reworked from underlying formations. The top of the formation has been planed flat, leaving behind a 1–2-m lag of boulders.

Some of the unusual features of the Beaufort Formation at its type location are about 100 species of vascular plants, 50 bryophyte (non-vascular) species, and 80 species of arthropods, mostly beetles. This is an amazing variety for such a high latitude. However, there are no tree stumps, soils, root zones, or other evidence for plant growth. Some of the plants include types that grow in the boreal forests well south, such as spruce, larch, pine, alder, and birch, but it also includes other types atypical of boreal forest, such as hemlock, fir, cypress, rose, water lily, dogwood, honeysuckle, mint, and hickory. Many of the beetles live in the warmer latitudes to the south today. The fossils indicate a warmer, wetter climate prevailed during deposition.

Moss is found in minor layers of 'peat', which is mainly composed of fine woody debris. The peat layers and lenses are up to 30 cm thick. The moss species do not grow together.[39] So, the peat and moss had to have been *transported*. Today, most moss species in the Arctic live further south.

The Beaufort Formation has generally been dated Miocene, Pliocene, and Quaternary, but has been refined recently to the Pliocene of the late Cenozoic, based on fossil correlations with Meighen Island to the north-east.

Other islands

The Beaufort Formation is generally similar on the other islands of the north-west Queen Elizabeth Islands. On Meighen Island it is 220 m thick. The same indicators of a warm climate have been found, including fossils of the eastern cedar that is now found much farther south. One mysterious feature is the occurrence of cross-bedded woody lenses, which have never been found in environments today or in sedimentary rocks.[41] It is believed that the wood must have been waterlogged to form cross-beds, but as the wood remains burnable it is more likely not to have been waterlogged, or it has dried out since deposition.

The Beaufort Formation on north-west Banks Island is a strange case. Researchers thought north-west Banks Island was all Beaufort Formation until they 'discovered' many fossils that were 'too warm' in the lower part of the formation. They therefore 'redated' it to the Mid Miocene, based on inferred climate.[42,43] The lower strata were renamed the Ballast Brook Formation. Some of the very warm climate fossils they found are the swamp cypress, tulip tree, and the *Azolla* fern. Matthews even found a plant restricted today to the tropics and subtropics that he believed must have had a "cool-climate variety".[44] There does not appear to be much of a gap at the contact, which represents about 10 million years of missing time, except for a layer of peat with vertical stumps just below the top of the Ballast Brook Formation. This is but one more example of uniformitarian scientists changing their dates to match new research and is one of the reasons why we cannot use a precise date in the geological column for locating the Flood/post-Flood boundary.

The 'Beaver Pond' site

There are many possible remnants of the Beaufort Formation on Ellesmere Island, generally in high terraces along valleys and fjords.[45] Probably the most perplexing is the 'Beaver Pond' site on southern Ellesmere Island at the head of Strathcona Fjord (figure 3). However, it is 2,000 km south-east of the rest of the Beaufort Formation, and may not be related to it at all. It is assumed to be the Beaufort Formation, since it has similar paleoflora.

The site is within 10–40 m of sand and gravel that caps the eroded top of the Eureka Sound Formation.[46] The formation is capped by glacial deposits. The site is also in peat that is assumed to have been a beaver pond, because of the existence of an extinct type of beaver and beaver cut sticks.[47,48] The peat is located in a terrace 300 m above sea level on the side of a valley that exits into Strathcona Fjord. The peat has mostly extant species of moss and beetles. There are also rooted larch trunks up to 3 m tall.

Unlike the Beaufort Formation, it has many vertebrate fossils, such as the beaver, rabbit, dog, shrew, rodent, badger, horse, deer, camel, and bear.[20,47,49] They are dated as Pliocene and placed in the Beaufort Formation. A fish fossil, similar to a walleye or sauger, admittedly is from Pleistocene strata farther south. All these fossils imply a climate about 18°C warmer than today, but they claim discontinuous permafrost and ice wedge casts.[20]

The Beaufort Formation and the Flood/post-Flood boundary

From criteria that I have developed for the location of the Flood/post-Flood boundary,[1] several aspects of the Beaufort Formation would imply a post-Flood environment. The formation is not well-cemented, the wood looks fresh, many of the fossils are from living forms, and there are rapid

Figure 4. Braided stream of the north fork of the Toutle River, Washington, US

facies changes, beaver-cut sticks, and moss. However, the Beaufort Formation seems slightly more likely to be a Flood deposit because of its broad extent over the 60,000 km^2 area. It is most likely a result of sheet flow coming from the south-east and moving into the deepening Arctic Ocean. The area was subsequently dissected into islands, separated by channels and straits, that can be as deep as 500 m.[39,50] The channels between the Queen Elizabeth Islands are believed by uniformitarian scientists to have been formed by rivers in the Oligocene to Pliocene.[51] Sheet deposition, followed by deep channelized dissection, fits nicely within the Recessive Stage of the Flood.

Today, braided streams are nearly always less than a few kilometres wide (figure 4). It is extremely unlikely a braided stream formed a deposit over 1,200 km wide. A planation surface caps the formation. The Beaver Pond site was probably made before the channels were cut.[46] It seems unlikely the Beaufort Formation is post-Flood. It would take too much time for the forests to grow, and a 'catastrophe' to lay down sheet deposits over a huge area, and deep channelized erosion to take place after the Flood and before the Ice Age.

I would place the Beaufort Formation in the Abative Phase of the Flood during sheet deposition in coastal locations and on the continental margin. Late in the Flood, during the Dispersive Phase, the area was dissected by channelized flow that separated the area into islands. Planation surfaces are unique features of the Flood.[52,53]

The Flood boundary is below the Gubik Formation in northern Alaska

Along the north slope of Alaska, from the Brooks Range to the continental shelf, the Cenozoic strata consists mainly of the Sagavanirktok and the Gubik formations.[54,55] The Sagavanirktok Formation is dated as mostly Paleogene with possibly some Upper Cretaceous in the west.[56] It is composed of 2,600 m of sandstone, bentonitic shale, conglomerate, and coal that covers the top of the Colville Basin that is greater than 10 km deep. As with the Eureka Sound Formation in relation to the Sverdrup Basin, all but possibly the top of this formation would likely be from the Flood, especially because of the coal.

The Gubik Formation mantles the coastal plain up to 60 m above sea level.[55] It is up to 60 m thick onshore and perhaps a few hundred metres thick on the continental shelf. It is mostly marine, unconsolidated, and divided into at least six 'transgressions'.[57] It overlies an erosional surface that cuts across Cretaceous and Tertiary sedimentary rocks. The formation is said to be similar all along the eastern and western shores of the Bering Sea, the Bering Strait, and Chukchi Sea.[58] It is 'correlated' with the Beaufort Formation on the north-west coastal plain of the Queen Elizabeth Islands, but this is probably just because the Beaufort Formation is also dated Pliocene.

The uniformitarian age of the Gubik Formation has been controversial. It was once dated late Pleistocene and fit within the last two 'ice ages' defined from the US Midwest.[59] Based mainly on amino-acid geochemistry, fossils, strontium isotopes, and paleomagnetic dating, the Gubik Formation is now dated Pliocene to late Pleistocene. There are three 'transgressions' dated to the Pliocene or possibly up into the very early Pleistocene based on isolated outcrops. These transgressions are indistinguishable and rarely superimposed vertically. They are separated in time mainly by various dates, especially amino-acid geochemistry,[55] which means that the Gubik Formation could simply be one instance of high sea level giving different dates in different places. There seem to be numerous problems with the dating methods, including tenuous fossil correlations, problematic amino-acid dates, thermoluminescence dates that are too variable, C-14 dates that had to be tossed, failed paleomagnetic analysis, and Sr isotope dating that failed at one location.[55,58,60] Again, we cannot use uniformitarian dates to locate the Flood/post-Flood boundary.

The character of the vegetation and the fossils, including sea otter fossils, indicate the climate was very warm.[61,62] The sea otter fossils were once dated as 2.4–3 Ma[61] but were changed to 1.7–2.6 Ma based on its 'stage of evolution'. Forests of spruce and birch indicate the climate was too warm for permafrost and Arctic sea ice.[57] However, there are ice-rafted rocks from the Ice Age in the Pleistocene section of the Gubik Formation. There also could be glacial rocks in the Pliocene layers. Some fossils indicate colder conditions, such as a harp seal fossil and lemming fossils.

Although the Gubik Formation is widespread, it is thin and lies *on* a planation surface, which was likely formed by

Flood runoff. It could easily have been deposited when the global sea level was about 67 m above the current sea level at the start of the Ice Age because there were no ice sheets on Antarctica and Greenland. Other aspects would point to the Ice Age, especially since the top of the formation has Ice Age indicators.

Implications

At least three implications for creationists result from this study, including uniformitarian dating problems, biblical history, and timing of the Bering Land Bridge.

Cannot depend on uniformitarian dates

From an analysis of the formations in northern North America, I place the Flood/post-Flood boundary above the Pliocene Beaufort Formation, north-west Queen Elizabeth Islands, and between the Sagavanirktok and the Pliocene Gubik Formation in northern Alaska. The analysis demonstrates why we cannot use the uniformitarian geological names or epochs to define the boundary, and why we must evaluate each location on its own merits.

Dating and taxonomic problems are two areas where we cannot use the uniformitarian system, except in a crude sense. McNeil states: "Biostratigraphic resolution is a fundamental problem in the Arctic because of the general absence of standard indices such as planktonic foraminifers and nannoplankton."[63] For instance, a horse jaw with several teeth was found at the Beaver pond site and claimed to be from *hipparion*,[49] probably because that is one of the horses that supposedly lived during the Pliocene. Another example is Bustin's dating of what is now considered the upper Eocene Eureka Sound Group as the Pliocene Beaufort Formation. He based the date on what was considered an index fossil.[31]

Circular reasoning conjured these two 'dates'. Climatic circular reasoning pigeon-holed the lower Beaufort Formation on north-west Banks Island 10 Ma earlier into the mid-Miocene because the fossils were considered too warm. Brigham-Grette and Carter admit that 'climate history' is an *input* into the resultant dates.[57]

Even epoch boundaries have changed. The upper Miocene was once considered the lower Pliocene, and more recently the upper Pliocene was changed to the lower Pleistocene when the Pliocene/Pleistocene boundary was pushed back from 1.8 Ma to 2.6 Ma.[64]

Biblical history

Once the Flood/post-Flood boundary is determined at one place it provides insight into the pre-Flood, Flood, and post-Flood history. The large amounts of fresh-looking wood found in the Cenozoic include species from the boreal forests farther south. The large quantities of moss transported along with ground-up plant material (peat) and deposited in the Beaufort Formation indicate the pre-Flood forests were moss-laden at high latitude. This suffices to conclude that the north polar area may have had a relatively cool climate before the Flood, and the forests were transported and buried in the Beaufort Formation sometime during the Flood. The Beaufort Formation is unique in many ways and demonstrates that sheet deposition along the continental margin can also have rapid changes in facies.

During the Flood, the very warm climate trees and plants, such as found on Axel Heiberg Island, could have been deposited by log mats that floated north, occasionally mixing with the local cool climate plants and trees.

After the Flood, there would be no mystery as to why the early Ice Age Arctic was much warmer than it is today, and why Prince Patrick Island, as well as other islands or parts of the other islands of the north-west Queen Elizabeth Islands, were never glaciated. Immediately after the Flood the Arctic Ocean was very warm, which would have resulted in warmer atmospheric temperatures near the ocean than today. It is interesting that there is very little indication of permafrost or sea ice in the Gubik Formation, as predicted by the post-Flood Ice Age model.[9] Warm onshore flow would prevent the ice and permafrost from forming near the Arctic coast.

According to the uniformitarian model, glacial temperatures would be much colder than today, while interglacial temperatures would be similar to today. Under these conditions, secular scientists would expect glaciation close to the Arctic Ocean, as well as in the lowlands of Alaska, Siberia, and the Yukon Territory of Canada. They would also expect permafrost and sea ice to have existed in the Arctic for millions of years.

The Bering Land Bridge

The timing of the Bering Land Bridge between Asia and North America has implications for the migration of mammals and man that left the Ark and crossed to North America. The shallow Bering Strait is only about 50–55 m deep and the continental shelf off Siberia is very wide. Figure 5 shows the area that would be exposed if sea level

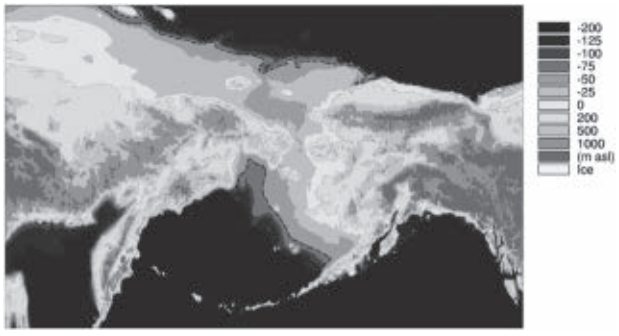

Figure 5. The Bering Land Bridge delineated with the 75 m contour dashed (modified from NOAA by Melanie Richard)

were 75 m lower than today, or the area tectonically raised 75 m. The Bering Land Bridge would have been exposed at the peak of the Ice Age due to low sea level, but by that time winters would be turning bitterly cold with permafrost and bogs developing.

We assume that the animals spread around the world before man, who spent over 100 years in the Tigris/Euphrates region before spreading. Did the animals spread across the land bridge early in the Ice Age? They would have then continued to migrate down the ice-free corridor through Alberta, Canada, and Montana into the United States or along the coast from south-east Alaska to Washington state and then into Central and South America. There would have been little or no permafrost or bogs, and winter temperatures would have been much warmer in Siberia than today early in the Ice Age. Nothing would have impeded their progress.

It is likely the animals arrived early in the Ice Age and well before people, since abundant animal fossils are found in Pleistocene sediments in the Americas. Even some animals that could not tolerate much cold found their way to the Americas and may have passed through the Bering Land Bridge early in the Ice Age. An alternative method of migrating to the Americas would have been rafting on log mats.[38] Was the Bering Land Bridge tectonically uplifted early in the Ice Age?

It is interesting that uniformitarian scientists believe the Bering Land Bridge was dry before about 4.5 Ma in the Early Pliocene.[65,66] If the Flood/post-Flood boundary was just below the Pliocene Gubik Formation in Alaska, this would support the idea that this area was tectonically uplifted and exposed early in the Ice Age, despite high global sea levels. There are Pacific fossils in the lower Gubik Formation, which implies the Bering Strait was open for part of the deposition of this formation, which is mostly marine. However, some uniformitarians believe the Bering Land Bridge existed since the mid Cretaceous,[67] with the closing date of the land bridge, at about 3 Ma, likely determined by the need to account for the similar fossils on Eurasia and North America.[49] Evidence is currently lacking for the early Ice Age exposure of the Bering Land Bridge and more research is needed.

Summary

The Arctic coastal plain sediments of North America are difficult to classify as to whether they are Flood, post-Flood, or both. Based on criteria developed for locating the Flood/post-Flood boundary, and despite some contrary evidence, the most significant evidence points to the boundary being above the Beaufort Formation of Canada and below the Gubik Formation of Alaska. These boundary designations remain tentative. This is one example where the boundary locations are equivocal, assuming the geological column for sake of reference.

References

1. Oard, M.J., *The Flood/Post-Flood Boundary Is in the Late Cenozoic with Little Post-Flood Catastrophism*, michael.oards.net/PostFloodBoundary.htm, 2014.
2. Oard, M.J., Flood processes into the late Cenozoic—sedimentary rock evidence, *J. Creation* **30**(2):67–75, 2016.
3. Oard, M.J., Flood processes into the late Cenozoic: part 3—organic evidences, *J. Creation* **31**(1):51–57, 2017.
4. Oard, M.J., Flood processes into the late Cenozoic: part 4—tectonic evidence, *J. Creation* **31**(1):58–65, 2017.
5. Oard, M.J., Flood processes into the late Cenozoic: part 5—geomorphological evidence, *J. Creation* **32**(2):70–78, 2018.
6. Oard, M.J., Were the Wind River terraces caused by multiple glaciations? *CRSQ* **50**(3):154–171, 2014.
7. Oard, M.J., Relating the Lava Creek ash to the post-Flood boundary, *J. Creation* **28**(1):104–113, 2014.
8. Archer, M., Hand, S.J., and Godthelp, H., *Riversleigh: The story of animals in ancient rainforests of inland Australia*, Reed Books, New South Wales, Australia, 1991.
9. Oard, M.J., *Frozen in Time: Woolly mammoths, the Ice Age, and the biblical key to their secrets*, Master Books, Green Forest, AR, 2004.
10. Reed, J. K., Kulikovsky, A.S., and Oard, M.J., Can recolonization explain the rock record? *CRSQ* **46**(1):27–39, 2009.
11. Granz, A., Johnson, L., and Sweeney, J.F. (Eds.), *The Arctic Ocean Region: The geology of North America, Volume L*, Geological Society of America, Boulder, CO, 1990.
12. Salzmann, U., Williams, M., Haywood, A.M., Johnson, A.L.A., Kender, S., and Zalasiewicz, J., Climate and environment of the Pliocene warm world, *Palaeogeography, Palaeoclimatology, Palaeoecology* **309**:1–8, 2011.
13. Salzmann *et al.*, ref. 12, p. 5.
14. Csank, A.Z., Tripati, A.K., Patterson, W.P., Eagle, R.A., Rybczynski, N., Ballantyne, A.P., and Eiler, J.M., Estimates of Arctic land surface temperatures during the Early Pliocene from two novel proxies, *Earth and Planetary Science Letters* **304**:291–299, 2011.
15. Salzmann *et al.*, ref. 12, p. 4.
16. Brigham-Grette, J., *et al.*, Pliocene warmth, polar amplification, and stepped Pleistocene cooling recorded in NE Arctic Russia, *Science* **340**:1421–1427, 2013.
17. Ballantyne, A.P., Greenwood, D.R., Sinninghe Damsté. J.S., Csank, A.Z., Eberle, J.J., and Rybczynski, N., Significantly warmer Arctic surface temperatures during the Pliocene indicated by multiple independent proxies, *Geology* **38**(7):603–606, 2010.
18. Ballantyne, A.P., Rybczynski, N., Baker, P.A., Harington, C.R., and White, D., Pliocene Arctic temperature constraints from the growth rings and isotopic composition of fossil larch, *Palaeogeography, Palaeoclimatology, Palaeoecology* **242**:188–200, 2006.
19. Pagani, M., Liu, Z., LaRiviere, J., and Ravelo, A.C., High Earth-system climate sensitivity determined from Pliocene carbon dioxide concentrations, *Nature Geoscience* **3**:27–30, 2010.
20. Rybczynski, N., Gosse, J.C., Harington, C.R., Wogelius, R.A., Hidy, A.J., and Buckley, M., Mid-Pliocene warm-period deposits in the High Arctic yield insight into camel evolution, *Nature Communications* **4**:1–9, 2013.
21. Salzmann *et al.*, ref. 12, p. 2.
22. Wayman, E., Forests once covered Arctic, *Science News* **183**(12):13, 2013.
23. Fedorov, A.V., Dekens, P.S., McCarthy, M., Ravelo, A.C., deMonocal, P.B., Barreiro, M., Pacanowski, R.C., and Philander, S.G., The Pliocene paradox (mechanisms for a permanent El Niño), *Science* **312**:1485–1489, 2006.
24. Fedorov, A.V., Brierley, C.M., Lawrence, K.T., Liu, Z., Dekens, P.S., and Ravelo, A.C., Patterns and mechanisms of Early Pliocene warmth, *Nature* **496**:43–49, 2013.
25. Pagani, M., Broken tropical thermostats, *Nature Geoscience* **7**:555–556, 2014.
26. O'Brien, C.L., Foster, G.L., Martinez-Boti, M.A., Abell, R., Rae, J.W.B., and Pancost, R.D., High sea surface temperatures in tropical warm pools during the Pliocene, *Nature Geoscience* **7**:606–611, 2014.
27. Marincovich, Jr., L., Brouwers, E.M., Hopkins, D.M., and McKenna, M.C., Late Mesozoic and Cenozoic paleogeographic and paleoclimatic history of the Arctic Ocean Basin, based on shallow-water marine faunas and terrestrial vertebrates; in: Granz, A., Johnson, L., and Sweeney, J.F. (Eds.), *The Arctic Ocean Region: The geology of North America, vol. L*, Geological Society of America, Boulder, CO, p. 414, 1990.

28. Riediger, C.L., Bustin, R.M., and Rouse, G.E., New evidence for the chronology of the Eurekan Orogeny from south-central Ellesmere Island, *Canadian J. Earth Science* **21**:1286–1295, 1984.
29. West, R.M., Dawson, M.R., Hickey, L.J., and Miall, A.D., Upper Cretaceous and Paleogene sedimentary rocks, eastern Canadian Arctic and related North Atlantic areas; in: Kerr, J.W. and Fergusson, A.J. (Eds.), *Geology of the North Atlantic Borderlands*, Canadian Society of Petroleum Geologists, Memoir 7, p. 295, 1981.
30. Riediger, C.L. and Bustin, R.M., The Eureka Sound Formation, southern Ellesmere Island, *Bulletin of Canadian Petroleum Geology* **35**(2):123–142, 1987.
31. Bustin, R.M., Beaufort Formation, eastern Axel Heiberg Island, Canadian Arctic Archipelago, *Bulletin of Canadian Petroleum Geology* **30**(2):140–149, 1982.
32. Ricketts, B.D., Sedimentation, Eurekan tectonism and the fossil forest succession on eastern Axel Heiberg Island, Canadian Arctic Archipelago; in: Christie, R.L. and McMillan, N.J. (Eds.), *Tertiary fossil forests of the Geodetic Hills, Axel Heiberg Island, Arctic Archipelago*, Geological Survey of Canada, bulletin 403, pp. 1–27, 1991.
33. Riediger *et al.*, ref. 28, p. 1288.
34. Christie, R.L. and McMillan, N.J. (Eds.), *Tertiary fossil forests of the Geodetic Hills, Axel Heiberg Island, Arctic Archipelago*, Geological Survey of Canada, bulletin 403, 1991.
35. Oard, M.J., Mid and high latitude flora deposited in the Genesis Flood—Part II: a creationist hypothesis, *Creation Research Society Quarterly* **32**(3):138–142, 1995.
36. Oard, M.J., Cold oxygen isotope values add to the mystery of warm climate wood in NE Canada, *J. Creation* **17**(1):3–5, 2003.
37. Obst, J.R. *et al.*, Characterization of Canadian Arctic fossil woods; in: Christie, R.L. and McMillan, N.J. (Eds.), *Tertiary fossil forests of the Geodetic Hills, Axel Heiberg Island, Arctic Archipelago*, Geological Survey of Canada, bulletin 403, pp. 123–146, 1991.
38. Oard, M.J., *The Genesis Flood and Floating Log Mats: Solving geological riddles*, Creation Book Publishers, Powder Springs, GA. 2014.
39. Fyles, J.G., Beaufort Formation (late Tertiary) as seen from Prince Patrick Island, Arctic Canada, *Arctic* **43**(4):393–403, 1990.
40. Devaney, J.R., Clastic sedimentology of the Beaufort Formation, Prince Patrick Island, Canadian Arctic islands: Late Tertiary sandy braided river deposits with woody detritus beds, *Arctic* **44**(3):206–216, 1991
41. Davies, N.S., Gosse, J.C., and Rybczynski, N., Cross-bedded woody debris from a Pliocene forested river system in the High Arctic: Beaufort Formation, Meighen Island, Canada, *J. Sedimentary Research* **84**:19–25, 2014.
42. Fyles, J.G., Matthews, Jr., J.V., Barendregt, R., Baker, J., Irving, E., and Jetté, H., Ballast Brook and Beaufort Formations (late Tertiary) on northern Banks Island, Arctic Canada, *Quaternary International* **22**/**23**:141–171, 1994.
43. Williams, C.J., Mendell, E.K., Murphy, J., Court, W.M., Johnson, A.H., and Richter, S.L., Paleoenvironmental reconstruction of a Middle Miocene forest from the western Canadian Arctic, *Palaeogeography, Palaeoclimatology, Palaeoecology* **261**:160–176, 2008.
44. Matthews, Jr., J.V., Plant macrofossils from the Neogene Beaufort Formation on Banks and Meighen islands, District of Franklin, *Geological Survey of Canada,* paper 87–1A, pp. 73–87, 1987.
45. Matthews, R., J.V. and Fyles, J.G., Late Tertiary plant and arthropod fossils from the high-terrace sediments on Fosheim Peninsula, Ellesmere Island, Nunavut, *Geological Survey of Canada*, bulletin 529, 2000.
46. Tedford, R.H. and Harington, C.R., An Arctic mammal fauna from the Early Pliocene of North America, *Nature* **425**:388–390, 2003.
47. Murray, A.M., Cumbaa, S.L., Harington, C.R., Smith, G.R., and Rybczynski, N., Early Pliocene fish remains from Arctic Canada support a pre-Pleistocene dispersal of percids (Teleostei: Perciformes), *Canadian J. Earth Sciences* **46**:557–570, 2009.
48. Rybczynski, N., Woodcutting behavior in beavers (Castoridae, Rodentia): estimating ecological performance in a modern and a fossil taxon, *Paleobiology* **34**(3):389–402, 2008.
49. Hulbert, R.C. and Harington, C.R., An Early Pliocene hipparionine horse from the Canadian Arctic, *Palaeontology* **42**(6):1017–1025, 1999.
50. Dixon, J. and Dietrich, J.R., Canadian Beaufort Sea and adjacent land areas; in: Granz, A., Johnson, L., and Sweeney, J.F. (Eds.), *The Arctic Ocean Region: The geology of North America, Volume L*, Geological Society of America, Boulder, CO, p. 240, 1990.
51. Trettin, H.P., The Arctic Islands; in: Balley, A.W. and Palmer, A.R. (Eds.), *The Geology of North America—An overview*, Geological Society of America, Boulder, CO, pp. 349–369, 1989.
52. Oard, M.J., *Flood by Design: Receding water shapes the earth's surface*, Master Books, Green Forest, AR, 2008.
53. Oard, M.J., *Earth's Surface Shaped by Genesis Flood Runoff*, (ebook), Michael. oards.net/GenesisFloodRunoff.htm, 2013.
54. Granz, A., May, S.D., and Hart, P.E., Geology of the Arctic continental margin of Alaska; in: Granz, A., Johnson, L., and Sweeney, J.F. (Eds.), *The Arctic Ocean Region: The geology of North America, vol. L*, Geological Society of America, Boulder, CO, p. 264, 1990.
55. Dinter, D.A., Carter, L.D., and Bringham-Grette, J., Late Cenozoic geological evolution of the Alaskan North Slope and adjacent continental shelves; in: Granz, A., Johnson, L., and Sweeney, J.F. (Eds.), *The Arctic Ocean Region: The geology of North America, vol. L*, Geological Society of America, Boulder, CO, pp. 450–490, 1990.
56. Moore, T.E., Wallace, W.K., Bird, K.J., Karl, S.M., Mull, C.G., and Dillon, J.T., The geology of northern Alaska; in: Plafker, G. and Berg, H.C. (Eds.), *The Geology of Alaska: The geology of North America, vol. G-1,* Geological Society of America, Boulder, CO, pp. 49–140, 1994.
57. Bringham-Grette, J. and Carter, L.D., Pliocene marine transgressions of northern Alaska: circumarctic correlations and paleoclimatic interpretations, *Arctic* **45**(1):74–89, 1992.
58. Bringham-Grette, J. and Hopkins, D.M., Emergent marine record and paleoclimate of the last interglaciation along the northwest Alaskan coast, *Quaternary Research* **43**:159–173, 1995.
59. Dinter *et al.*, ref. 55, p. 460.
60. Brouwers, E.M., Late Pliocene paleoecologic reconstructions based on ostracode assemblages from the Sagavanirktok and Gubik Formations, Alaskan North Slope, *Arctic* **47**(1):16–33, 1994.
61. Carter, L.D., Brigham-Grette, J., Marincovich, Jr., L., Pease, V.L., and Hillhouse, J.W., Late Cenozoic Arctic Ocean sea ice and terrestrial paleoclimate, *Geology* **14**:675–678, 1986.
62. Repenning, C.A., New evidence for the age of the Gubik Formation Alaskan North Slope, *Quaternary Research* **19**:356–372, 1983.
63. McNeil, D.H., Tertiary marine events of the Beaufort-Mackenzie Basin and correlation of Oligocene to Pliocene marine outcrops in Arctic North America, *Arctic* **43**(4):302, 1990.
64. Pillans, B. and Gibbard, P., The Quaternary period; in: Gradstein, F.M., Ogg, J.G., Schmitz, M.D., and Ogg, G.M. (Eds.), *The Geologic Time Scale 2012*, vol. 2, pp. 979–1010, 2012.
65. Marincovich Jr, L. and Gladenkov, A.Y., Evidence for an early opening of the Bering Strait, *Nature* **397**:149–151, 1999.
66. De Schepper, S., Schreck, M., Beck, K.M., Matthiessen, J., Fahl, K., and Mangerud, G., Early Pliocene onset of modern Nordic Seas circulation related to ocean gateway changes, *Nature Communications* **6**(8659):1–8, 2015.
67. Repenning, C.A. and Brouwers, E.M., Late Pliocene-early Pleistocene ecologic changes in the Arctic Ocean borderland, *U.S. Geological Survey*, bulletin 2036, Washington, D.C., 1992.

Michael J. Oard *has an M.S. in atmospheric science from the University of Washington and is now retired after working as a meteorologist with the US National Weather Service in Montana for 30 years. He is the author of* Frozen in Time, Ancient Ice Ages or Gigantic Submarine Landslides?, Flood by Design, Dinosaur Challenges and Mysteries, *and* Exploring Geology with Mr. Hibb. *He serves on the board of the Creation Research Society.*

Baraminic analysis of archaic and modern human genomes

Jean O'Micks

A recent paleogenomic study compared the whole genomes and several subgenomic regions of modern human and those of Neanderthal and Denisovan. This genomic comparison helps shed more light on the taxonomic relationships between modern and archaic humans than do prior morphological studies. The current paper seeks to interpret the results from this recent study and draw relevant implications for baraminology. Based on anthropological and genetic evidence, we should expect to find similarities between modern human and Neanderthal and Denisovan, and also differences between them and members of the ape holobaramin, such as chimpanzee. For example, there are several global genomic characteristics of the human, Neanderthal, and Denisovan genomes which underscore their similarity. Also, deletions of genomic regions present in archaic and missing from modern humans show that the human baranome underwent devolution, as opposed to evolution. Certain so-called 'accelerated' regions in the human genome are also present, and in some cases identical in the Neanderthal and Denisovan genomes, setting them apart from species in other baramins, such as apes. Overall, besides morphological and behavioural characteristics, genomic characteristics also bespeak the unity between members of the human holobaramin and differences between them and the ape holobaramin.

With the sequencing of the complete genomes of the archaic humans Neanderthal[1] and Denisovan,[2] small-scale genomic comparisons have been possible.[3] However, until now only one full-scale analysis and comparison of the whole genome sequence of modern and archaic humans has been performed.[4] In this study they scored, ranked, and compared the motifome (sequence motifs of lengths 6–10 bp), promoter regions, and introns of human, Neanderthal, and Denisovan. This has important scientific consequences in that, besides the characterization and comparison of fossil skeletal remains, a global analysis of the whole genome sequence can give us a deeper insight into the baraminic relationships between these three variants of humans and those of other species.

With the exception of the followers of the 'progressive' creationist school of Hugh Ross, there is little doubt that modern humans are related to two archaic variants of humans. Diverging from over 100 years of tradition, many modern studies now refer to them as subspecies of *Homo sapiens*, that is Neanderthal (*Homo sapiens neanderthalensis*) and Denisovan (*Homo sapiens denisova*).[5] Previous creationist studies have highlighted the flow of genetic material between modern humans and Denisovans, for example.[6] The Denisovan tooth is trapezoidal in shape, which is similar to *Homo erectus*.[7]

In this paper we will analyze the results coming from the Cserhati *et al.* study and derive conclusions which are important for the baraminic status of the human holobaramin. Baraminology involves an analysis of the relationship between different kinds of animals along biblical lines. A 'baramin' is made up of species corresponding to the kinds mentioned in Genesis 1. The 'holobaramin' corresponds to the full species membership of one of the kinds created during Creation Week. For example, dogs, wolves, jackals, and coyotes would belong to a single holobaramin[8]. A 'baranome' is a pluripotent, undifferentiated genome with an intrinsic ability for rapid adaptation and speciation.[9] Essentially, a pluripotent baranome can give rise to multiple species within a single holobaramin within the biblical timeframe.

According to baraminology, species within a kind should show some degree of continuity with one another, and discontinuity with species from other kinds. Thus, there should be a close relationship between human genomes. Conversely, human genomes should differ distinctly from the genomes of other kinds, such as apes.

General genomic characteristics of modern and archaic humans compared to those of chimpanzee

At a macroscopic level, the Neanderthal and Denisovan genomes are very similar to that of modern human. The genome size of all three human morphological variants is around 3 Gbp. All three have 23 pairs of chromosomes, as opposed to chimpanzee, which has 24 pairs. Previous creationist research has strongly argued that there is no site on human chromosome 2 which supposedly came about via the fusion of chimpanzee chromosomes 2a and 2b.[10,11] Table 1 lists general genomic characteristics of the genomes of modern human, Neanderthal, Denisovan, and chimpanzee

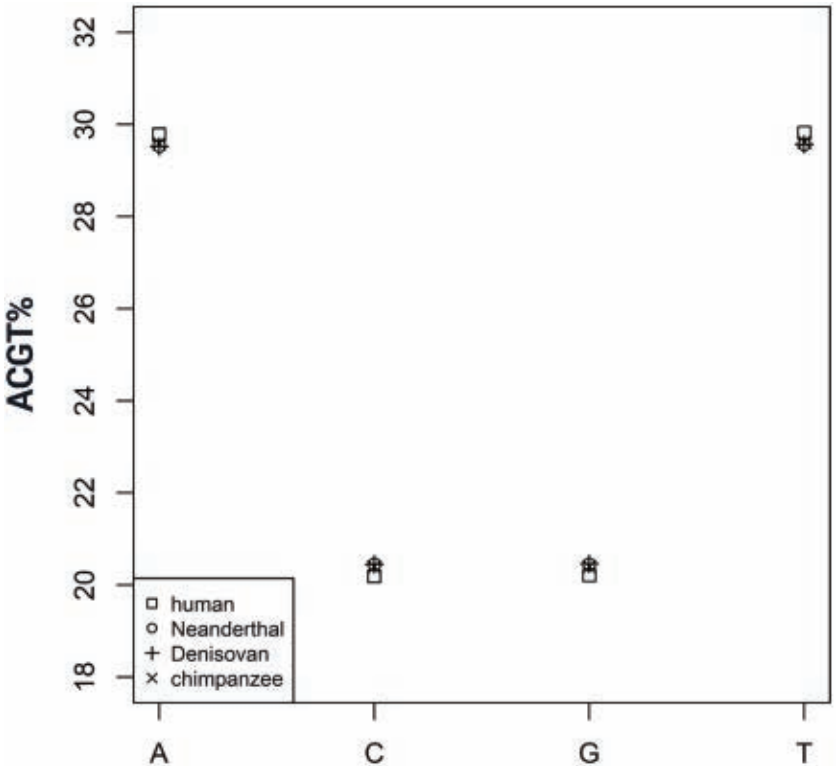

Figure 1. ACGT% in genomes of modern human, Neanderthal, Denisovan, and chimpanzee

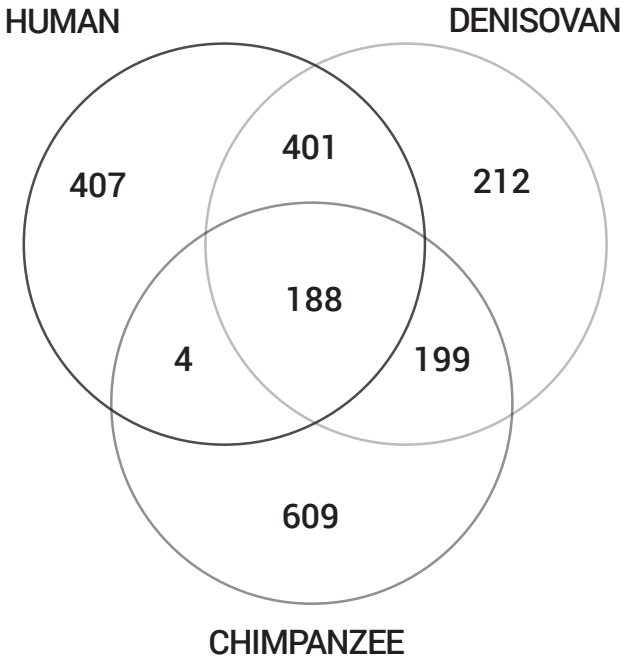

Figure 2. Number of common octamers from the top 1,000 octamers from the proximal promoter regions between modern human, Denisovan, and chimpanzee

for comparison. Figure 1 visualizes the ACGT% for all four genomes.

According to the Cserhati *et al.* study, 86.2% of the 1,000 highest-scoring hexamer whole-genome motifs are found in common among all three human morphological variants, whereas only 5.2% of their top 1,000 decamer whole-genome motifs are in common. This may be due to differential recombination or gene conversion with strong drift in Neanderthal and Denisovan in the intergenic regions.

On a subgenome level, things are more similar between modern human and Denisovan. For example, they have 96.5% of the 1,000 highest-scoring hexamer motifs in common in core promoters. Among decamers, 86.9% of their top 1,000 decamer motifs are in common in the core promoters (as opposed to the mere 5.2% common decamer motifs in the whole genome). This is significant, in that this implies that, to a very large part, the core regulatory machinery of the genes between modern human and Denisovan is the same.

It has been established that the whole-genome similarity between modern humans and chimpanzees is not more than 85%.[12] Thus, despite the fact that, on a macroscopic level, the genomes of both modern and archaic humans and chimpanzee have approximately the same ACGT%, the significant difference in their genome sequence still implies that there is discontinuity between the human holobaramin and chimpanzee. Deyneko *et al.*[13] studied the sequence similarity of promoter regions between modern human and chimpanzee and found that, although 6,050 of the 9,329 promoters they studied were more than 65% similar, the similarity around 35% of the studied promoters (3,279) was less than 90%. Furthermore, they performed in-depth promoter comparison only on chromosome 21. This implies that many chimpanzee promoters could be very differently regulated than the promoters of their homolog genes in human. Heissig *et al.*[14] also think that there are differences in proximal promoter activity between humans and chimpanzees. As many as 10% of all genes in the brain are differentially expressed between humans and chimpanzees.[15] This is significant as it affects cognition, which is a very important differentiating factor between humans and non-humans. Another study showed that fully 80% of proteins are different between humans and chimpanzees.[16] Demuth *et al*. also showed that humans have 689 genes not present

Table 1. General characteristics of the genomes of modern and archaic humans and chimpanzee

Species	No. chromosomes	Size of genome (Gbp)	No. proteins predicted by Augustus	ACGT%
Homo sapiens	23	3.21	33,321	29.78%/20.19%/20.21%/29.82%
Neanderthal	23	2.85	33,049	29.53%/20.45%/20.45%/29.57%
Denisovan	23	3.00	32,733	29.52%/20.45%/20.46%/29.57%
Chimpanzee	24	3.23	46,094	29.59%/20.39%/20.4%/29.62%

Table 2. Alignment similarities between the proximal promoters of modern human, Denisovan, and chimpanzee

First species	Second species	Average similarity	Average length	Average matching bases
Human	Chimpanzee	97.27%	462.5 bp	449.9 bp
Denisovan	Chimpanzee	95.61%	477.0 bp	456.1 bp
Human	Denisovan	99.79%	459.2 bp	458.2 bp

in chimpanzee, and that chimpanzees have 86 genes that are lacking in human, and that their DNA differs by 6%, as opposed to the oft-cited figure of only 1.5%.[17]

In our own comparison, we obtained the proximal promoter sets (1 Kbp sequences) for chimpanzee from the UCSC Genome Browser, the promoters for modern human from the Eukaryotic Promoter Database, and the Denisovan promoters from the website of Cserhati *et al.* for supplemental data and performed mutual sequence comparisons (alignments) among all three. Promoters for Neanderthal are not yet available. The results can be seen in table 2. We observe that the average alignment length (that is, the average length of the most homologous region of the promoter between the two species, the promoters of which are being compared) is about the same for all three species comparisons. However, the average alignment *similarity* between modern human and Denisovan was almost identical at 99.79%, whereas the average similarity between chimpanzee and the two human morphological variants was lower at 95.61% and 97.27% for the Denisovan-chimpanzee and the modern human-chimpanzee comparisons, respectively. Figure 2 shows a Venn diagram depicting the number of common octamers coming from the top 1,000 octamers from the proximal promoter regions between modern human, Denisovan, and chimpanzee. Modern human and Denisovan have a higher ratio of overlapping common top-scoring octamers at 41.7%. This ratio is lower between chimpanzee and modern human at 10.6% and between chimpanzee and Denisovan at 24%.

Conserved deleted regions in human

McLean *et al.*[18] studied 584 so-called hCONDEL (human conserved deletions) regions in chimpanzee and human. These appear in intergenic regions of the chimpanzee genome (median size of 2,804 bp) but are missing from the human genome. It would be interesting to see whether these regions correspond to any regions in the Neanderthal or Denisovan genomes. If they do, this would mean that these genomic regions have been deleted from modern human genomes. This would support the idea of the devolution of the human baranome through time, as opposed to the evolutionary assumption of genomic build-up.

For example, Hinds *et al.*[19] found 215 deletions within 600 Mbp of the human genome ranging from 70 bp to 10 Kbp, 41 of which had an allele frequency of at least 10%. These may represent a source of common genetic variation, and which also may cause phenotypic differences in complex traits. Similarly, McCarroll *et al.*[20] found 541 deletion variants ranging from 1 to 745 Kbp—278 of which were found in multiple, unrelated individuals. Deletions were found in the exons of ten genes in the homozygous state, two of which were related to olfaction. Similarly, Hughes *et al.*[21] found that several combinations of 20 olfactory receptors (OR) were differentially lost in modern humans, Neanderthals, and Denisovans.

According to the Cserhati *et al.* study, of the 583 hCONDEL regions, 287 (49.2%) of them had a significant hit at least 50bp long in at least one of the archaic human genomes, with at least 90% sequence identity. This means that

Table 3. Location of 49 Human Accelerated Regions (HARs) in the human genome, number of matching motifs from Neanderthal and Denisovan, and number of HARs matching between human and Neanderthal and Denisovan (after Cserhati *et al.* 2018). An additional two in the coding region and one in the RNA were not studied further.

Region	Number of HARs	No. of matching Neanderthal motifs/HAR regions	No. of matching Denisovan motifs/HAR regions
Intergenic regions	26	184/26	175/25
Introns	20	not studied	160/18

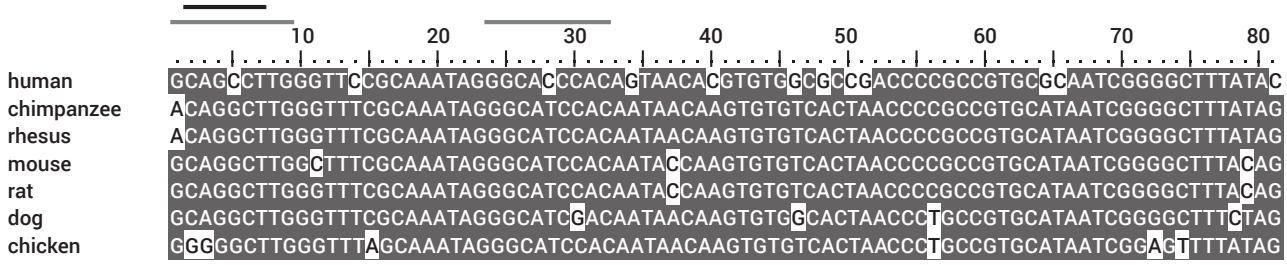

Figure 3. The 81-bp segment from the enhancer element between the CENTG2 and GBX2 genes on human chromosome 2, showing 13 human-specific substitutions, compared with the corresponding region in chimpanzee, rhesus, mouse, rat, dog, and chicken

about half of these deletions happened after the split between modern and archaic humans.

Human accelerated sequences

Prabhakar *et al.*[22] studied a 546-bp enhancer element between the CENTG2 and GBX2 genes on human chromosome 2 inside what they called the human-accelerated conserved non-coding sequence 1 (HACNS1). This is responsible for differential limb development in mammals, and is expressed in the anterior limb bud, pharyngeal arches, ear, and eye in the developing embryo. Compared to chimpanzee, mouse, rat, dog, and chicken, this enhancer element has 16 human-specific substitutions. Furthermore, a shorter, 81-bp segment contains 13 of these 16 substitutions (figure 3).

Evolutionists argue that, for some unknown reason, this part of the human genome underwent accelerated mutation, which led to differential human morphology. However, if this is true, then it remains a mystery as to how and why this small, isolated segment of the genome remained relatively conserved while the surrounding region changed through evolutionary time. This implies that this enhancer element, with its special human-specific functionality, was differentially created in the human genome.[23] It should also be noted that position 1 in this 81-bp stretch of DNA is the same in chimpanzee and the rhesus macaque, which could arguably belong to a monkey holobaramin. The same is true for positions 37 and 79 for mouse and rat.

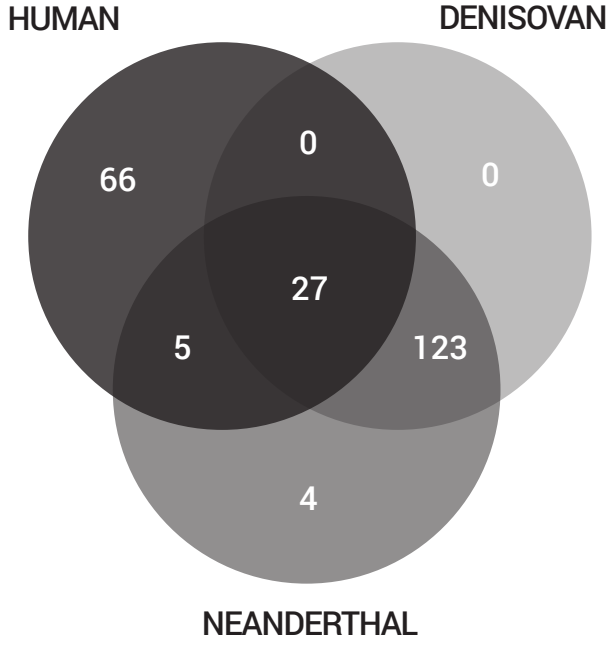

Figure 4. Intergenic motifs in Human Accelerated Regions (HARs) shared among modern human, Neanderthal, and Denisovan

This 81-bp segment is identical in Denisovan and modern humans, which implies that they belong to the same holobaramin. Furthermore, according to the Cserhati *et al.* study, a genome motif, CAGCCT, which was found within this 81-bp segment (black bar in figure 3), was found to be among the highest-scoring motifs in modern human, whereas the high-scoring motifs GCAGCCTTG and GGCACCCAC (grey bars in figure 3) were discovered in Denisovan, implying that this enhancer has biological function in both variants of human.

Besides HACNS1, Pollard *et al.*[24] identified 49 Human Accelerated Regions (HARs) with substantial functional differences between human and other mammals. Forty-six of these are located in non-coding regions of the genome, but also have significant BLAST hits with the genomes of Neanderthal and Denisovan. Table 3 lists the number of these elements in different subregions of the genome of modern human. Also listed are the number of significant motifs from Neanderthal and Denisovan which match these human HARs and the number of HARs which have a match in different subgenomic regions of the Neanderthal and Denisovan genomes. The Cserhati *et al.* study identified 225 statistically significant whole genome motifs in modern human, Neanderthal, and Denisovan which were found in 26 intergenic HAR regions identified by Pollard *et al.* Modern human shares approximately the same proportion of intergenic motifs with Neanderthal (14.2%), as with Denisovan (12.2%), whereas Neanderthal and Denisovan share 94.3% of these motifs among themselves (see figure 4).

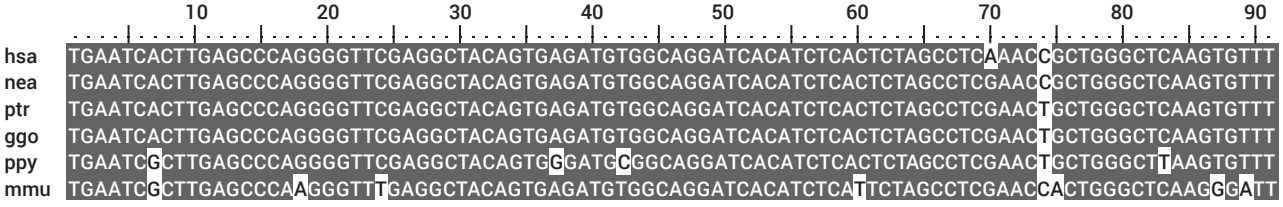

Figure 5. Significant MicroRNA species motifs in 91 bp miR-1304 sequence: hsa = *Homo sapiens*; nea = Neanderthal; ptr = *Pan troglodytes*; ggo = *Gorilla gorilla*; ppy = *Pongo pygmaeus*; mmu = *Mus musculus*.

Motif content similarity within the miR-1304 microRNA element

MicroRNA species have been known to regulate as much as 30% of all genes in human, and also take part in complex cellular networks.[25] The miR-1304 element has been shown to be involved in dental and craniofacial differences[26] and regulates two genes, ENAM and AMTN, which take part in odontogenesis.[27] Five Neanderthal motifs from the Cserhati *et al.* study (with the consensus sequence of CCTGCCTCG) were found to overlap the seed region (a conserved core region of the miR-1304 sequence which binds with the mRNA of the gene that it is regulating) of miR-1304, GCCTCGA (here the underlined part of the consensus motif sequence and the seed region indicate where they overlap). It should also be mentioned that the target site for the miR-1304 element in the 3' UTR of both the ENAM and AMTN genes is exactly the same.

Neanderthals were known to have different craniofacial characteristics compared to modern humans, and the differential expression of genes involved in tooth formation might cause phenotypic differences between Neanderthals and modern humans, even though they belong to the same holobaramin. For example, modern humans have thicker enamel than Neanderthals do, possibly due to the miR-1304 element.[26,28]

Ten significant motifs from the Cserhati *et al.* study from modern humans and two from Neanderthal were found in the 22-bp seed motif of miR-1304 (CACATCTCACTGTAGCCTC[A/G]AA). The 91 bp miR-1304 sequence (figure 5) contains only 1 bp difference between modern human and Neanderthal, whereas a difference exists at two different positions between modern human and two ape species, chimpanzee and gorilla, and a difference at six positions between modern human and orangutan.

Conclusions

The genomes of modern humans, Neanderthals, and Denisovans are very similar to each other. Besides this general similarity (genome size, number of proteins, ACGT%, chromosome number), they also have a similar high-scoring motif content. Since some genomic regions (hCONDELs) are present in the genomes of archaic humans but missing in modern human, this shows that the human baranome is devolving, not evolving. Also, on a finer level of genetic elements, such as among human accelerated regions and microRNAs, we see that archaic human sequences are nearly identical to modern humans. This suggests that modern and archaic humans are members of the human holobaramin. Thus, besides morphology[29] and behavioural characteristics,[30] Neanderthals are similar to modern humans genomically, something which has been demonstrated in previous studies, but has now been demonstrated on a sub-genome level as well.

While chimpanzees may have a similar ACGT% to humans, their *overall* genome similarity is different. Furthermore, on a gene regulatory level, chimpanzee promoters are dissimilar, implying that divergent genetic regulation is the reason behind the phenotypic differences between humans and chimpanzees. The genomes of archaic and modern humans are much more similar to one another, and different from all other species. This implies common ancestry for the three. Modern and archaic humans form one single species, *Homo sapiens*. Truly, according to Acts 17:26: "And he made from one man every nation of mankind to live on all the face of the earth" (ESV).

Materials and Methods

The Neanderthal and Denisovan whole-genome sequence and Denisovan core promoter set was downloaded from golgi.unmc.edu/HumanMotifomeData. A set of 1,577 proximal promoters for chimpanzee was downloaded from the UCSC Genome Browser at hgdownload.soe.ucsc.edu/goldenPath/panTro5/bigZips/upstream1000.fa.gz. Human, Denisovan and chimpanzee proximal promoters (human proximal promoters were downloaded from the Eukaryotic Promoter Database, EPD)[31] were aligned with the BLAST algorithm[32] using the *-n* parameter setting to search in MEGABLAST mode, which is useful in aligning longer sequences that differ only slightly from one another. The number of protein sequences for modern human, Neanderthal, Denisovan, and chimpanzee were predicted by using version 2.5.5 of the Augustus gene prediction

algorithm,[33] using human as a comparison species. Figure 1 was created in R, version 3.4.3. Figure 2 was created using the Venn diagram software at bioinformatics.psb.ugent.be/cgi-bin/liste/Venn/calculate_venn.htpl. Figures 3 and 5 were created using version 7.2.6.1 of BioEdit.[34] Figure 4 was taken from the Cserhati *et al.* paper with the author's permission.

References

1. Green, R.E., Krause, J., Briggs, A.W. *et al.*, A draft sequence of the Neanderthal genome, *Science* **328**:710–722, 2010.
2. Meyer, M., Kircher, M., Gansauge, M.T. *et al.*, A high-coverage genome sequence from an archaic Denisovan individual, *Science* **338**:222–226, 2012.
3. Reich, D., Green, R.E., Kircher, M. *et al.*, Genetic history of an archaic hominin group from Denisova Cave in Siberia, *Nature* **468**:1053–1060, 2010.
4. Cserhati, M., Mooter, M., Peterson, L. *et al.*, Motifome comparison between modern human, Neanderthal and Denisova, *BMC Genomics* **19**:472, 2018.
5. Gunbin, K.V., Afonnikov, D.A., Kolchanov, N.A., Derevianko, A.P. and Rogaev, E.I., The evolution of *Homo sapiens denisova* and *Homo sapiens neanderthalensis* miRNA targeting genes in the prenatal and postnatal brain, *BMC Genomics* 16 Suppl 13:S4, 2015.
6. Savanne, D., Denisovans menace evolution—a new chapter in the human origins debate, *J. Creation* **28**(3):5–8, 2014.
7. Zanolli, C., Hourset, M., Esclassan, R., and Mollereau, C., Neanderthal and Denisova tooth protein variants in present-day humans, *PLoS One* **12**(9):e0183802, 2017.
8. Pendragon, B., A review of selected features of the family Canidae with reference to its fundamental taxonomic status, *J. Creation* **25**(3):79–88.
9. Teerborg, P., Evidence for the design of life: part 2—Baranomes, *J Creation* **22**(3):68–76, 2008.
10. Tomkins, J.P., Alleged human chromosome 2 'fusion site' encodes an active DNA binding domain inside a complex and highly expressed gene—negating fusion, *Answers Research J.* **6**:367–375, 2013.
11. Tomkins, J., A Response to criticism and obfuscation regarding refutation of the human Chromosome 2 fusion, *Answers Research J.* **10**:45–54, 2017.
12. Tomkins, J., Analysis of 101 chimpanzee trace read data sets: assessment of their overall similarity to human and possible contamination with human DNA, *Answers Research J.* **9**:294–298, 2016.
13. Deyneko, I.V., Kalybaeva, Y.M., Kel, A.E., and Blöcker, H., Human–chimpanzee promoter comparisons: property-conserved evolution? *Genomics* **96**(3):129–133, 2010.
14. Heissig, F., Krause, J., Bryk, J., Khaitovich, P., Enard, W., and Pääbo, S., Functional analysis of human and chimpanzee promoters, *Genome Biol* **6**(7):R57, 2005.
15. Uddin, M., Wildman, D.E., Liu, G. *et al.*, Sister grouping of chimpanzees and humans as revealed by genome-wide phylogenetic analysis of brain gene expression profiles, *PNAS* **101**:2957–2962, 2004.
16. Glazko, G., Veeramachaneni, V., Nei, M., and Makałowski, W., Eighty percent of proteins are different between humans and chimpanzees, *Gene* **346**:215–219, 2005.
17. Demuth, J.P., De Bie, T., Stajich, J.E., Cristianini, N., and Hahn, M.W., The evolution of mammalian gene families, *PLoS One.* **1**:e85, 2006.
18. McLean, C.Y., Reno, P.L., Pollen, A. *et al.*, Human-specific loss of regulatory DNA and the evolution of human-specific traits, *Nature* **471**:216–219, 2011.
19. Hinds, D.A., Kloek, A.P., Jen, M., Chen, X., Frazer, K.A., Common deletions and SNPs are in linkage disequilibrium in the human genome, *Nature Genetics* **38**(1):82–85, 2005.
20. McCarroll, S.A., Hadnott, T.N., Perry, G.H. *et al.*, Common deletion polymorphisms in the human genome, *Nature Genetics* **38**(1):86–92, 2005.
21. Hughes, G.M., Teeling, E.C. and Higgins, D.G., Loss of olfactory receptor function in hominin evolution, *PLoS One* **9**(1):e84714, 2014.
22. Prabhakar, S., Visel, A., Akiyama, J.A. *et al.*, Human-specific gain of function in a developmental enhancer, *Science* **321**:1346–1350, 2008.
23. Tomkins, J., Human uniqueness and accelerated storytelling: how conserved regulatory regions in the genome challenge evolution, *CRSQ* **52**:256–264, 2016.
24. Pollard, K.S., Salama, S.R., Lambert, N. *et al.*, An RNA gene expressed during cortical development evolved rapidly in humans, *Nature* **443**:167–172, 2006.
25. Filipowicz, W., Bhattacharyya, S.N., and Sonenberg, N., Mechanisms of post-transcriptional regulation by microRNAs: are the answers in sight? *Nat. Rev. Genet.* **9**:102–114, 2008.
26. Lopez-Valenzuela, M., Ramírez, O., Rosas, A. *et al.*, An ancestral miR-1304 allele present in Neanderthals regulates genes involved in enamel formation and could explain dental differences with modern humans, *Mol. Biol. Evol.* **29**:1797–1806, 2012.
27. Sire, J.Y., Davit-Béal, T., Delgado, S. and Gu, X., The origin and evolution of enamel mineralization genes, *Cells Tissues Organs* **186**:25–48, 2007.
28. Buti, L., Le Cabec, A., Panetta, D. *et al.*, 3D enamel thickness in Neandertal and modern human permanent canines, *J. Hum. Evol.* **113**:162–172, 2017.
29. O'Micks, J., *Homo naledi* probably not part of the human holobaramin based on baraminic re-analysis including postcranial evidence, *Answers Research J.* **9**:263–272, 2016.
30. O'Micks, J., Modern science catches up with Neanderthal man, *J. Creation* **32**(1):38–42, 2018.
31. Dreos, R., Ambrosini, G., Cavin Périer, R. and Bucher, P., EPD and EPDnew, high-quality promoter resources in the next-generation sequencing era, *Nucleic Acids Res.* **41**:157–164, 2013.
32. Altschul, S.F., Gish, W., Miller, W., Myers, E.W. and Lipman, D.J., Basic local alignment search tool, *J. Mol. Biol.* **215**:403–410, 1990.
33. Stanke, M., Keller, O., Gunduz, I., Hayes, A. *et al.*, AUGUSTUS: ab initio prediction of alternative transcripts, *Nucleic Acids Res.* **34**(Web Server issue):W435–9, 2006.
34. Hall, T.A., BioEdit: a user-friendly biological sequence alignment editor and analysis program for Windows 95/98/NT, *Nucl. Acids Symp. Ser.* **41**:95–98, 1999.

Jean O'Micks *has a Ph.D. in biology. He has been an active creationist for 17 years and takes a great interest in molecular biology. He has published a number of articles in* Journal of Creation.

Paleoanthropology in Australia—*Homo erectus* and modern human origins

Peter Line

Robust human fossil remains have been found in Australia, at sites like Kow Swamp and the Willandra Lakes region. Their identity in relation to specimens of *Homo erectus*, and their role in human ancestry, has been a controversial one. This issue will be addressed in this article, as well as models of modern human origin that attempt to explain the robusticity seen in early Australians. Also touched on is the politics that has seemingly paralyzed much of Australian paleoanthropology for decades. The Out of Africa and Multiregional evolutionary theories of modern human origins are considered, as well as an explanation based on biblical events.

Homo erectus

Eugene Dubois, responsible for the 1891 discovery of the first *Homo erectus* specimen (known back then as *Pithecanthropus erectus*), in Java, Indonesia, claimed that his "*Pithecanthropus* was a 'venerable ape-man'".[1] A more current view of *Homo erectus*, by evolutionists, is that it is "an early-to-mid-Pleistocene species thought to be on the direct ancestral line to modern humans".[2] According to Campbell and Loy, *Homo erectus* individuals "seem to have a modern body build", in regard to the postcranial skeleton, but "differed greatly from modern people in their brain size and cranial anatomy".[3] Paleoanthropologist Daniel Lieberman writes that "In essence, *H. erectus* was the first ancestor we can characterize as significantly human."[4] *Homo erectus* expert Susan Antón states:

> "… our opinion of *H. erectus* has changed as our understanding of human evolution has matured. Initially seen as perhaps no more than a fossil ape or a regional isolate, *H. erectus* is now considered the hominin that was the first to take major anatomical and behavioral steps in the direction of a 'modern human' body plan."[5]

According to paleoanthropologist Chris Stringer:

> "Most anthropologists recognize the existence of at least two human species during the last million years—the extinct *Homo erectus* and our own species, *Homo sapiens*—but there are very different views on how these species are related."[6]

Whilst evolutionists may refer to *Homo erectus* as a human species, what that means is generally different from the belief of most creationists, that *Homo erectus* individuals were fully human and hence descendants of Adam and Eve. This paper is not so much about the features of *Homo erectus*, but rather, considers evidence for *erectus*-like fossil specimens having been found in Australia. While finding *Homo erectus* fossils in Australia would not be a problem for the creationist position, it does cause problems for evolutionary theories of modern human origins that regard *Homo erectus* as a less evolved human. One reason for this is that, according to Bae *et al*.:

> "It has long been argued that modern humans were the only hominin taxon capable of peopling Australasia, particularly because it would have involved the ability to build sturdy watercraft and navigate the open seas."[7]

Homo erectus showing up in Australia would be a major problem for evolutionary models of human origins, such as the Out of Africa (OoA) theory, because, as indicated above, this model suggests that *Homo erectus* did not have the intelligence to make well-built watercraft and navigate the open seas, which would be required to reach Australia. It also makes it harder to argue that *Homo erectus* individuals were less intelligent than modern humans.

An even bigger problem, though, is that if the robustly built humans known to have been in Australia were *erectus*-like, and if Australian Aborigines, as believed, are linked to (i.e. descended from) both the gracile (anatomically modern) and robust (i.e. *erectus*-like) people, as well as people with a "more middle of the road morphology",[8] what does that mean if *Homo erectus* is not considered fully human (i.e. a member of *Homo sapiens*)? Regarding questions like these, evolutionists from the multiregional school of thought have expressed concerns about OoA (or Eve) theorists defining the species *Homo sapiens* too restrictively, as follows:

> "We believe that an unfortunate aspect of the debate are definitions of *Homo sapiens* used by some 'Eve' theorists. They have been found to exclude many Pleistocene and more recent Aboriginal Australians from our species … . Further examination of these individuals and collections of recent Aboriginal skeletal remains leads us to estimate that these definitions of modern *Homo sapiens* exclude anywhere between 40 000 and 60 000 living Aboriginal Australians. We feel that there is great danger in this. It is the duty of

specialists to make sure that they include all living people in any definition of our species. If we do define humans as minimally including all living people, many of the fossils that the 'Eve' theorists claim leave no descendants, including Neanderthals, fall into *Homo sapiens*."[9]

Kow Swamp

When Thorne and Macumber described the human remains from Kow Swamp, Australia (the first remains were discovered in 1967; figure 1) in the journal *Nature*, in 1972, they wrote:

"Analysis of the cranial morphology of more than thirty individuals reveals the survival of *Homo erectus* features in Australia until as recently as 10,000 years ago."[10]

From this it might seem that the question of *erectus*-like fossils existing in Australia was already answered in the affirmative back then, but a changing political climate in the 1980s, as well as the increasing influence of the OoA theory of modern human origins during the same decade, meant any such claims would be challenged. For example, it has been suggested that "the 'robust' Australian crania that look the most archaic, like Cohuna and Kow Swamp 1 and 5, have been shown to share strong shape similarities with known artificially deformed crania".[11] Commenting on suggestions that some specimens from Kow Swamp (KS) had been artificially deformed, Darren Curnoe stated:

"However, a recent study (Curnoe and Thorne, 2006b) [see Curnoe and Thorne[12]] has found no evidence for such modification in KS 1 [figure 2] and the case for artificial deformation in KS 5 [figure 3] to be at best very weak. Other relevant specimens from Australia such as Cohuna, WLH 50, KS 8, KS 9, Mossgiel, LM 3 and King Island are incomplete and many standard measurements cannot be reliably taken on them (Curnoe and Thorne, 2006a) [see Curnoe and Thorne[13]]."

Figure 2. A cast of the Kow Swamp 1 (KS 1) *Homo sapiens* cranium from Kow Swamp, Victoria, Australia. It is a 'robust' cranium, but does not appear to be artificially deformed. (Photo taken by Peter Line at the Smithsonian National Museum of Natural History, Washington, DC, in 2013.)

Figure 1. A view at Kow Swamp, Victoria, Australia (Photo taken by Peter Line in 2013)

Other researchers, including Arthur Durband, disagree with Curnoe's assessment, with Durband stating that the results from his analysis "show that Kow Swamp 1 and 5 have strong shape similarities to known deformed individuals".[14] Reporting on a "new discriminant function for the identification of artificially deformed crania", Clark *et al*. scored Kow Swamp 5 as artificially deformed, but not Kow Swamp 1.[15] From their results the authors stated:

"These results provide further support for the argument that

Figure 3. A cast of the Kow Swamp 5 (KS 5) *Homo sapiens* cranium from Kow Swamp, Victoria, Australia. It is a 'robust' cranium, but some argue it has been artificially deformed. (Photo taken by Peter Line at the American Museum of Natural History, New York, in 2009.)

> deformation is present in some specimens in the early Australian sample, and, as such, it is not appropriate to use cranial characteristics 'shared' between Indonesian hominids and early Australians with evidence of deformation to infer linkages between the two populations."[16]

While one can agree with the above statement, it should not mean that crania that do not appear to be artificially deformed (e.g. Kow Swamp 1) cannot be used as evidence of linkage between populations, if indeed that is what it shows. There is disagreement about whether (or which) Kow Swamp specimens show possible evidence of having been artificially deformed, but getting a definitive resolution to the argument may be out of reach. This is because of the policy of repatriation of ancient remains that was starting to take place in the 1980s which, concerning the Kow Swamp fossil remains, and according to John Mulvaney and Johan Kamminga, led to the Museum of Victoria in 1990 unconditionally returning "the entire collection to the Echuca Aboriginal community and presently its fate remains obscure".[17]

Changing political climate

Regarding the changing political climate alluded to, Arthur Durband and Michael Westaway have described the situation as follows:

> "Unfortunately, work on the prehistory of Australia was significantly impacted in the 1980s by changes in legislation surrounding the ownership of ancient remains … . Control was transferred to local Aboriginal groups, who reclaimed and reburied many of the Pleistocene human remains recovered by that point … . It also became much more difficult to publish data or photographs of ancient Australians, as control over the use of any data or images of the fossils also became subject to the discretion of the local Aboriginal groups. As a result, paleoanthropological fieldwork in Australia essentially ground to a halt as much of the modern debate over the origins of modern humans was beginning to take shape."[18]

Independent researcher Vesna Tenodi has written a less diplomatic view of the situation, as follows:

> "Ancient Australian skulls can not be investigated, nor reconstructed. Replicas or even drawings cannot be displayed, or discussed, as that also is too offensive and cannot be done without 'Aboriginal permission.' Even when skulls are clearly non-aboriginal, such as the Mungo Man or the Kow Swamp skeletons.
>
> "My conclusion is that all these enforced 'protocols' were invented to protect the political decision to maintain the dogma that Aborigines are the 'First people'."[19]

Given the above-mentioned situation with respect to Australian human fossils, one essentially has to rely on descriptions of fossils discovered before the change in political climate, such as the Kow Swamp and Willandra Lakes region fossils, to answer the question of whether *erectus*-like individuals were once in Australia. In discussing Australian skulls possibly affiliated with *Homo erectus*, including the Talgai skull, Pintupi skull, and the Kow Swamp and Coobool Creek skulls, Tenodi, who also describes herself as a 'spiritual archaeologist', believes the evidence "points at the parallel existence of both *Homo erectus* and *Homo sapiens*, and indicates the presence of much older, highly-evolved pre-Aboriginal cultures".[20]

Single Origin Model

Westaway writes that there are "very lightly built" (gracile) crania in the Willandra Lakes region, such as Mungo Lady (also known as Lake Mungo 1 or WLH 1) and Mungo Man (Lake Mungo 3 or WLH 3; figure 4), and there are also fossils in the same region from "very heavily built individuals".[21] The term 'robust' is often used in describing

Figure 4. A cast of the 'gracile' Willandra Lakes Human 3 (WLH 3) *Homo sapiens* cranium from the Willandra Lakes Region, New South Wales, Australia. The specimen is also known as Mungo Man or Lake Mungo 3. (Photo taken by Peter Line at the American Museum of Natural History, New York, in 2009.)

these specimens and the fossil humans from Kow Swamp, Victoria.[21] Their thick cranial vaults, large brow ridges and "pronounced areas of muscle attachment" are said to be "cranial distinguishing markings" of these robust individuals, the best known being Willandra Lakes Human 50 (WLH 50).[21] Hence, any Australian human origin model has to explain both the robust and gracile human forms.

The evolution-based dating methods give inconsistent dates for some of the Australian fossil remains, depending on the method used. The gracile specimen Lake Mungo 3 is dated as either 40 ka (on geological grounds) or about 61 ka (ESR and U-S dating), both of which are older than the Kow Swamp dates of about 13 to 9.5 ka (radiocarbon dates on shells) or 26 to 19 ka (optically stimulated luminescence).[22] Therefore, any model that accepts the ages given by these dating methods needs to also explain why a gracile human at the Willandra Lakes region appears to be dated earlier than the robust humans at Kow Swamp. The most mainstream evolutionist position to explain the gracile and robust groups of early Australians is probably the Single Origin Model (SOM), which proposes "that a single founding group initially populated Australia", as described by Durband and Westaway:

> "Instead, the observed range of biological variation can be accounted for by localized evolutionary processes combined with cultural factors like mate selection that would increase the potential for genetic drift. Additionally, cultural phenomena such as interpersonal violence and artificial cranial deformation also influenced cranial shape and thickness, accentuating some regional distinctions between populations. In short, a single origin model for the Australians, combined with the effects of selection, is perfectly consistent with the evidence and presents a parsimonious scenario."[23]

Proponents of the SOM are likely to be supporters of the Out of Africa (OoA) theory of modern human origins, who are said to "argue that the variation within the fossil sequence in the Willandra region represents the extremes of a homogenous population across Australia".[24] For the SOM to work, skulls similar to *Homo erectus*, like WLH 50, described by Durband and Westaway as "an exceptionally massive skull, one of the most robust modern humans yet discovered", must be explained away or downplayed, and so they state:

> "While it is often highlighted for its unusual, extreme morphology, it is because of this singular anatomy that WLH 50 is arguably of less importance for our understanding of modern human origins than any other single specimen in Australia."[25]

It is circular logic, and convenient, to say that the fossil which arguably is the most difficult for the single model to explain, is the least important because of its 'extreme morphology'. Peter Hiscock stated, "It seems reckless, as Brown … and Cameron and Groves … have argued, to base any interpretation of human evolution on this unusual, pathological individual", claiming it was likely that WLH 50 "suffered an illness that changed his crania [sic]", yet admitted "his particular problem has not been diagnosed".[26] Needless to say, the advice of ignoring WLH 50 will not likely be heeded by some researchers, and will not be adhered to in this paper. Durband and Westaway also write:

> "As WLH 50 is clearly unusual in its morphology, falls outside the normal range of variation for Pleistocene Australians, is likely pathological to some degree, and probably dates to at least 13 kyr after the initial colonization of Australia, it is perplexing that this individual has received this degree of notoriety in the debate over the origins of modern humans in Australia."[27]

Dihybrid Model

One of the competing mainstream evolutionary positions, supported by proponents of the Multiregional Continuity Model (MCM) of modern human origins, is that Australia was populated by two groups of humans, "each with a distinct evolutionary origin, that coexisted for long periods of time in the late Pleistocene".[28] As stated by Glenn Conroy and Herman Pontzer:

> "According to this theory, one group is represented by the robust Talgai, Cohuna and Kow Swamp specimens, which are seen as being derived from Indonesian *H. erectus* through such intermediaries as Ngandong. The second group is represented by the more gracile Mungo and Keilor fossils, which are

Figure 5. A view at Lake Mungo, part of the Willandra Lakes Region, New South Wales, Australia. The WLH 50 partial skull (the face, jaw and teeth did not survive), along with some hand, arm and foot bones, were found near Lake Garnpung, which lies close to Lake Mungo (Flood[32]). (Photo taken by Peter Line in 2014.)

seen as being derived from the Chinese *H. erectus* populations."[29]

This dual migration model, where "two very different populations arrived and intermixed to create the diversity of Aboriginal people", is known as the Dihybrid Model, and was advocated by the late Alan Thorne, who also linked it to the Multiregional Continuity Model of human evolution.[30] According to Hiscock, the multiregional model:

> "... hypothesized that modern humans evolved from earlier hominids in a number of regions, each with specific genetic traits but unified as a single, global species by inter-regional gene flow".[31]

Willandra Lakes Human 50 (WLH 50)

The WLH 50 remains were discovered on the surface, not *in situ*, near Lake Garnpung, in the Willandra Lakes region (figure 5), in 1980.[32] Regarding the WLH 50 cranium, there does not appear to be any claims about it having been artificially deformed, but as indicated earlier, it has been suggested that "its cranial vault profile is also likely anomalous due to pathology".[33] The age of WLH 50 is said to lie between 10.4 and 37.4 ka (thousand years ago), but most likely about 26 ka.[34] According to the authors of the dating analyses:

> "There is general agreement that WLH 50 is a modern human … . However, some see strong resemblances between WLH 50 and the Ngandong specimens … , whilst others attribute its robusticity to a pathological source … . However, detailed new studies refute the evidence for pathological hyperostosis of WLH 50 … . In a recent, comprehensive comparison of the metric and nonmetric features of WLH 50 with Levantine, African, and Ngandong specimens, Hawks *et al*. (2000) [see Hawks *et al*.[35]] concluded that WLH 50 was most closely related to the Ngandong specimens and that its robusticity was clearly attributable to its archaic rather than its pathological nature. Their conclusion, following Thorne and Wolpoff (1992) [see Thorne and Wolpoff[36]], was that WLH 50 belonged to the same species as Ngandong and was an example strongly endorsing the evolutionary model of regional continuity."[34]

From their analyses, indicating anatomical similarities, Hawks *et al*. concluded that "WLH-50 and other Late Pleistocene fossils are modern humans, and the clear implication of their links to Ngandong is that these older Indonesians are *H. sapiens* as well."[37] Steve Webb, who originally suggested pathology may explain (in part), the "exceptional cranial vault thickness" of WLH 50, writes:

> "It is clear that WLH 50 is a very robust individual with or without pathology, because other heavily developed features are clearly not pathological. Beside any pathology that might have moderately exaggerated its vault thickness, this individual would have had a thick vault in keeping with its other robust features."[38]

Even if WLH 50 had some pathology (which seems doubtful), there are other Willandra Lakes individuals that have, for example, cranial vault thicknesses and well-developed (robust) brow ridges within the *Homo erectus* range.[39] In the opinion of Webb, who has studied and described much of the fossil material recovered from the Willandra Lakes region:

> "The distinct morphology of some Australian fossil crania cannot have an origin anywhere else other than Indonesia, it is not something developed within Australia, an aberration of the Ice Age, nor can it be one end of a wide range of anatomically modern human morphology that came 'Out of Africa'. Indeed, it was precisely that anatomically modern humans were *not* cranially robust that distinguishes them as such. Whatever the genetic evidence suggests, the only people around to convey such an outstanding morphology must have been *Homo soloensis* or its descendants. There is no other Upper Pleistocene population from whom such a heavily built cranial structure could be inherited."[40]

Note that *Homo soloensis* is used by some when referring to the Ngandong *Homo erectus* series crania. According to Josephine Flood:

> "WLH 50 is massive: he is so robust, he makes Kow Swamp man look gracile! The cranium is extremely wide and approximately 210 millimetres long. The cranial vault bone averages 16 millimetres thick. Massive brow ridges form a continuous torus above the eyes, and the forehead is flat and receding. The back of the skull shows even more archaic characteristics,

with substantial cranial buttressing. The neck muscle area is huge, the skull is extremely wide, the greatest width occurs very low in back view, and the difference between the width above and below the ears is much greater than in any modern people. Yet WLH 50's brain was extremely large; the estimated endocranial volume is 1540 millilitres, well above the average 1300 for modern skulls."[41]

Clearly WLH 50, "regarded as a modern human in all origins models",[42] is a very robust skull. It closely resembles the Indonesian Ngandong (Solo Man) *Homo erectus* series crania, such as Ngandong 1 (see figure 6). There should not be this resemblance, though, if Solo Man was derived from *Homo erectus* 'hominids' that left Africa nearly 2 Ma (million years ago). If the OoA theory is correct WLH 50 should most closely resemble 'early' anatomically modern human crania, such as Qafzeh 9, the type it is supposedly derived from, but it does not, as reported by Wolpoff *et al*.[43]

The Out of Africa (OoA) Model

From an evolutionary perspective the OoA model has been the most popular and influential theory of modern human origins in the last two or three decades. The OoA model proposes that modern humans emerged out of Africa about 100,000 years ago, with the Neanderthals replaced by the spread of these modern humans into their regions, and

> "Like the Multiregional Model, this view accepts that fossils assigned to *Homo erectus* evolved into new forms of human in inhabited regions outside Africa, but argues that these non-African lines became extinct without evolving into modern humans."[44]

The key points of the Out of Africa theory are summarized by Colin Barras:

> "Most anthropologists believe that our species arose in Africa 200,000 years ago. Our genes show we are all descended from a single population that left Africa within the last 120,000 years and went global. This African group is the source of all human genes, barring a few gained by mating with species like Neanderthals."[45]

While a pure OoA scheme allows no interbreeding between the emerging African modern humans and 'resident archaic people', interbreeding is allowed to different extents in variants of the OoA theory.[46] The OoA model has fallen on hard times in recent years, particularly the pure replacement version of the model, as evidence of introgression between modern humans and supposedly more 'archaic lineages', like Neanderthals, have been piling up.[47] According to Posth *et al*., the mitochondrial DNA (mtDNA) in a femur "displaying archaic hominin morphology", from Germany, dated by them to 124 ka, indicated there had been "African mtDNA gene flow into Neanderthal populations", the introgression event said to have occurred between 460 ka and 219 ka.[48] Reporting on the study, Gibbon stated:

> "After comparing the mitochondrial DNA (mtDNA) with that of other archaic and modern humans, the researchers reached a startling conclusion: A female member of the lineage that gave rise to *Homo sapiens* in Africa mated with a Neandertal male more than 220,000 years ago—much earlier than other known encounters between the two groups."[49]

From an evolutionary point of view, the above 2017 study by Posth *et al*. seems to put early modern humans in Europe, which they constrain as "taking place more than

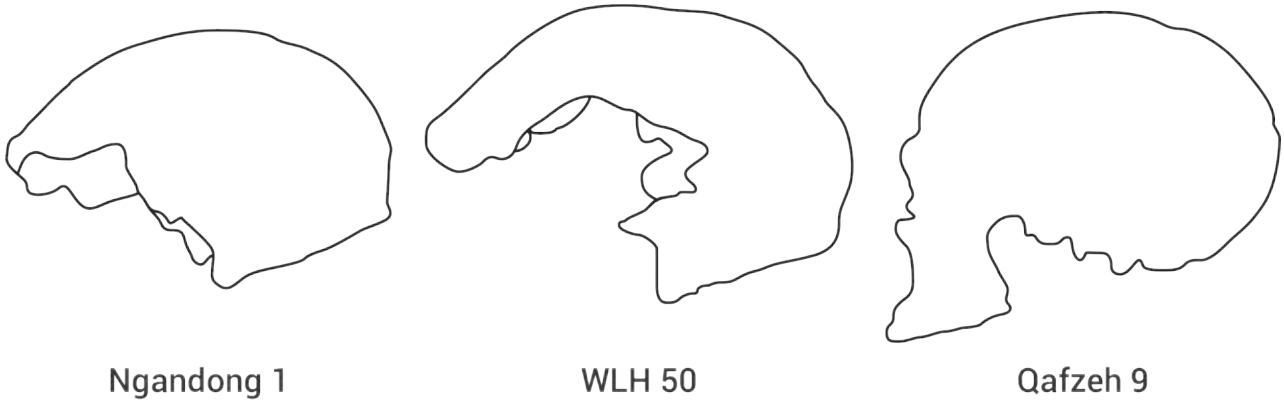

Figure 6. The above figure shows rough outlines of the crania: (left) Ngandong 1 from Java, Indonesia; (centre) WLH 50 from Australia; and (right) Qafzeh 9 from Israel. WLH 50 is a very robust cranium, exhibiting many *Homo erectus*-like features, e.g. continuous, massive brow ridges, thick cranial vault bones, flat and receding forehead, and angulated occipital—at the back. It closely resembles the Indonesian Ngandong (Solo Man) *Homo erectus* series crania, such as Ngandong 1. There should not be this resemblance, though, if Solo Man was derived from *Homo erectus* 'hominids' that left Africa nearly 2 Ma. If the Out of Africa theory is correct, WLH 50 should most closely resemble 'early' anatomically modern human crania, such as Qafzeh 9, the type it is supposedly derived from, but it does not. The above sketches were based on a photographic comparison of crania from a *Science* publication by Wolpoff *et al*.[42]

~270 ka",[50] at a time not only before they left Africa, but even before they had supposedly evolved in Africa (about 200 ka). This should be fatal to the OoA theory, no matter how much interbreeding is allowed in spin-offs of the theory, but, ironically, it is the fall of another key premise of the OoA tale that gives it some respite.

In 2017, a paper was published about a *Homo sapiens* fossil skull from Jebel Irhoud, Morocco, that was redated from about 160 ka to a much older 315 ka,[51] and so, purely from an evolutionary point of view, humans may have appeared much earlier in Africa than thought, and it may not have been in East Africa that they first appeared. This raised doubts about other aspects of the OoA theory, as some evolutionists likened the Jebel Irhoud skull to the Dali skull (sometimes affiliated with *Homo heidelbergensis* or *Homo erectus*) from China, dated to 260 ka, with confusing implications:

> "It's possible, she says, that the hominins in Africa weren't cut off from those in Eurasia. The small-scale movements of individuals—like young adults leaving a family group and joining a neighbouring one—could have allowed genes to flow across Africa and Eurasia. That means the genetic features of *H. sapiens* that appeared in Morocco 315,000 years ago could have cropped up in individuals—like the Dali skull's owner—in China 260,000 years ago. There is another implication. 'I think gene flow could have been multidirectional, so some of the traits seen in Europe or Africa could have originated in Asia,' says Athreya [researcher at Texas A&M University]. That means features associated with *H. sapiens* may have evolved in east Asia, and been carried to Africa. If so, our origins are not solely African."[45]

Even more recently, in 2018, a maxilla and associated dentition discovered at Misliya Cave, Israel, whose morphological traits were consistent with it being *Homo sapiens*, were dated from 177 to 194 ka, an age said to suggest "that members of the *Homo sapiens* clade left Africa earlier than previously thought".[52] Prior to this report, according to the authors, "the earliest modern human fossils found outside of Africa" were dated to around 90 to 120 ka, at the sites of Skhul and Qafzeh, also in Israel.[53] The only thing that can be said with any degree of certainty is that the preferred Out of Africa theory of modern human origins is in a state of confusion and contradiction, as central tenets of the theory have toppled like dominoes, one by one.

The Multiregional Continuity (MC) Model

The evolutionary alternative to the Out of Africa Model, known as the Multiregional (or Multiregional Continuity) Model, argues "that ancient ancestors of various human groups lived where they are found today".[54] In this view humans, as in *Homo erectus*, migrated out of Africa nearly two million years ago, to different regions of the world. But rather than being replaced by subsequent recent migrations, they evolved in parallel in these different geographic regions, it being thought that "gene flow between the groups through interbreeding spread important changes throughout and was sufficient to maintain humans as a single species".[55] The Multiregional Evolution Model is not short of critics either, with Richard Klein stating:

> "An obvious objection to multiregionalism is that it postulates substantial gene flow among small populations that were thinly scattered across three continents. In this light the multiregional model is not so much a theory as it is an after-the-fact explanation for proposed morphological resemblances between nonmodern and modern populations in Asia and Europe."[56]

From an evolutionary point of view, it does not seem credible that for nearly two million years gene exchange between small *Homo erectus* populations, thinly scattered across three continents, helped keep them all united as a single species, while the different populations evolved separately into the anatomical modern human form, all getting there around the same time. With both the Out of Africa and Multiregional evolutionary models of human origins struggling to deal with the evidence, the biblical explanation of human origins appears much more plausible.

A biblical model

Regarding both the Out of Africa and Multiregional evolutionary models of human origins, as well as fossil humans like the Neanderthals and *Homo erectus*, creationist Carl Wieland has stated:

> "I suggest that both contending evolutionary camps in this are each right about some things. There *is* a genetic continuity between us and these fossil humans, as both the fossil and nuclear DNA evidence shows. And we *are* all closely related, much closer in time, coming from one small population bottleneck (the Flood)—as the mtDNA evidence shows. Here, the biblical model would seem to provide the best of both worlds."[57]

Creationists have different interpretations of *Homo erectus* fossils, although most models acknowledge them as being definitely human. One possible explanation, which I prefer, as to why 'robust' humans such as *Homo erectus*, *Homo heidelbergensis* and Neanderthals were different in morphology to anatomically modern humans, particularly in the skull, is that it could reflect changes in development of these early post-Flood individuals, compared to anatomically modern humans, possibly linked to longevity.[58] It should be emphasized that I believe the key features of the robust

morphology arose during ontogeny (i.e. development from fertilization of egg up to organism's mature form). Whether this would have affected the time to reach maturation (i.e. attaining adult/mature form) is unclear, but this model does not require it to be different to extant humans. If the characteristic robust features were chiefly the result of developmental processes (genetically linked to greater longevity factors), then some of the robust fossils could be of individuals with the potential to live hundreds of years, and as such built robustly, but who died at a relatively young age (through illness, accident, conflict, etc.). If it was chiefly due to the aging process, every robust fossil discovered must, by default, have lived hundreds of years, which is unlikely; especially when some of the bony characteristics that distinguish these robust humans from moderns are already present in, for example, Neandertal specimens that are obviously still a long way from attaining adulthood, however long that may have taken.

Why would humans be designed more robustly when their lifespans were longer? Perhaps, having thickened cranial vault bones, a heavily built face, thick-boned jaws, and thick postcranial bones helped the body cope with long lifespans. If longevity was linked to development processes associated with robusticity, then robust features would be expected to disappear with shorter lifespans, although Wieland notes that "some of the genes coding for some of their distinctive bony anatomy were apparently passed on to some of today's populations".[59] Hence, robust features do not correlate with the potential for longevity in recent times. Add environmental influences, as well as genetic effects like genetic drift, and you can possibly account for differences in skeletal features observed not only between early post-Flood humans, like *Homo erectus*, *Homo heidelbergensis* and the Neanderthals, but also between anatomically modern humans and these early robust post-Flood humans. As such, there would be regional variations in form in the past, as there is with people groups today.

Whether it is argued that skulls such as WLH 50 are 'robust' modern humans, *Homo heidelbergensis*, *Homo erectus*, or 'archaic' *Homo sapiens*, these are moot points, from the perspective of the position taken here, which is that *Homo heidelbergensis* and *Homo erectus* are not separate species either. Rather, the members allocated to these categories are considered to be fully human, descendants of Adam and Eve, and so should be included in *Homo sapiens* (though for the sake of identifying their categories their current names of classification were used).[60]

Conclusions

The Kow Swamp series crania are one group of 'robust' human fossils from Australia that were found to have *Homo erectus*-like features, but controversy later occurred after claims that some of the crania (e.g. Kow Swamp 5) had been artificially deformed. However, there are other crania that do not appear to be artificially deformed (e.g. Kow Swamp 1), and so this argument cannot be used against all the fossils. The Kow Swamp fossil remains were repatriated to the local (Echuca) Aboriginal community in 1990, and so are no longer available for study.

Concerning the robust WLH 50 skull, its large cranial capacity, estimated at about 1540 cc,[41] would most likely have resulted in its arbitrary exclusion from *Homo erectus*, no matter where it had been found (an example of circular reasoning). However, the issue is not with attributing WLH 50 to a modern human, which is what it is, nor with seeing it as evidence of continuity with Ngandong *Homo erectus* populations. Rather, the problem is caused by not seeing Ngandong *Homo erectus* individuals as also modern humans (i.e. as *Homo sapiens* and descendants of Adam and Eve).

It clearly makes no sense to view the robust Willandra Lakes (e.g. WLH 50) and Ngandong individuals as separate species, but neither does it make sense to view some *Homo erectus* specimens (e.g. Ngandong) as modern humans, while viewing others (e.g. Sangiran or Zhoukoudian) as less evolved or subhuman.

If they are all considered as modern humans exhibiting a range of variation, i.e. as *Homo sapiens* and descendants of Adam and Eve, then there is no problem with the Willandra Lakes individuals being similar in morphology to the Ngandong individuals in Indonesia, as well as them being closely related. It is the belief in evolution, particularly the dominant 'Out of Africa' replacement model of human origins, that has caused the contradictions, as it cannot allow for robustly built humans, such as *Homo erectus* (or *Homo heidelbergensis* and Neanderthals for that matter), to be fully human.[61]

References

1. Campbell, B.G. and Loy, J.D., *Humankind Emerging* (8th edn), Allyn and Bacon, Needham Heights, MA, pp. 324–325, 2000.
2. Campbell and Loy, ref. 1, p. 325.
3. Campbell and Loy, ref. 1, p. 353.
4. Lieberman, D.E., *The Story of the Human Body*, Pantheon Books, New York, p. 72, 2013.
5. Antón, S.C., *Homo erectus* and related taxa, chap. 26; in: Begun, D.R. (Ed.), *A Companion to Paleoanthropology*, Wiley-Blackwell, West Sussex, UK, p. 497, 2013.
6. Stringer, C., *Lone Survivors: how we came to be the only humans on earth*, Time Books, New York, p. 15, 2012.
7. Bae, C.J., Douka, K., and Petraglia, M.D., On the origin of modern humans: Asian perspectives, *Science* **358(**eaai9067), p. 3, 2017 | doi: 10.1126/science.aai9067.
8. Webb, S.G., *The First Boat People*, Cambridge University Press, Cambridge, UK, pp. 250–251, 274, 2006.
9. Thorne, A. and Wolpoff, M., Conflict over modern human origins, *Search* **22**(5): 177, July/August, 1991.
10. Thorne, A.G. and Macumber, P.G., Discoveries of Late Pleistocene Man at Kow Swamp, Australia, *Nature* **238**:316, 1972.

11. Durband, A.C. and Westaway, M.C., Perspectives on the Origins of Modern Australians (Chapter 4, pp. 123–150); in: F.H. Smith and J.C.M. Ahern (Eds.), *The Origins of Modern Humans: Biology reconsidered*, 2nd edn, John Wiley & Sons, Inc., Hoboken, NJ, p. 129, 2013.
12. Curnoe, D. and Thorne, A., The question of cranial robusticity, *Before Farming*, on-line version, 2006/2 Article 2, 2006.
13. Curnoe, D. and Thorne, A., Human origins in Australia: the skeletal evidence, *Before Farming* (on-line version) 2006/1 Article 5, 2006.
14. Durband, A.C., Artificial cranial deformation in Kow Swamp 1 and 5: A response to Curnoe (2007), *HOMO—J. Comparative Human Biology* **59**:261–269, 2008.
15. Clark, J.L. *et al*., Identifying artificially deformed crania, *International J. Osteoarchaeology* **17**:596, 605, 2007.
16. Clark, J.L. *et al*., Identifying Artificially Deformed Crania, *International J. Osteoarchaeology* **17**:605, 2007.
17. Mulvaney, J. and Kamminga, J., *Prehistory of Australia*. Smithsonian Institution Press, Washington, p. 158, 1999.
18. Durband, A.C. and Westaway, M.C., Perspectives on the origins of modern Australians (Chapter 4, pp. 123–150); in: Smith, F.H. and Ahern, J.C.M. (Eds.), *The Origins of Modern Humans: Biology Reconsidered*, 2nd edn, John Wiley & Sons, Inc., Hoboken, NJ, p. 123, 2013.
19. Tenodi, V., Reconstructed face of a Stone Age woman unveiled in Greece would be forbidden in Australia, *Pleistocene Coalition News* **10**(1):16, January–February, 2018.
20. Tenodi, V., Australian archaeological paradox: Did *Homo erectus* linger here? *Pleistocene Coalition News* **6**(4):16–17, July–August, 2014.
21. Westaway, M., Human origins and the Mungo connection; in: Lawrence, H. (Ed.), *Mungo Over Millennia: The Willandra landscape and its people*, Maygog Publishing, Sandy Bay, Tasmania, pp. 24–30, 2006; p. 26.
22. Conroy, G.C. and Pontzer, H., *Reconstructing Human Origins: A Modern Synthesis*, 3rd edn, W.W. Norton & Company, New York, p. 592, 2012.
23. Durband and Westaway, ref. 18, pp. 128–130.
24. Westaway, ref. 21, p. 28.
25. Durband and Westaway, ref. 18, pp. 135–136, 138.
26. Hiscock, P., *Archaeology of Ancient Australia*, Routledge, London, p. 87, 2008.
27. Durband and Westaway, ref. 18, p. 138.
28. Conroy and Pontzer, ref. 22, pp. 592–594.
29. Conroy and Pontzer, ref. 22, p. 593.
30. Hiscock, P., ref. 26, pp. 93–94.
31. Hiscock, ref. 26, p. 94.
32. Flood, J., *Archaeology of the Dreamtime: The story of prehistoric Australia and its people*, rev. edn, Angus & Robertson, Sydney, pp. 40, 69, 1995.
33. Durband and Westaway, ref. 18, p. 133.
34. Grün, R., Spooner, N., Magee, J. *et al*, Stratigraphy and chronology of the WLH 50 human remains, Willandra Lakes World Heritage Area, Australia. *J. Human Evolution* **60**:597, 604, 2011.
35. Hawks, J., Oh, S., Hunley, K. *et al*., An Australasian test of the recent African origin theory using the WLH-50 calvarium, *J. Human Evolution* **39**:1–22, 2000.
36. Thorne, A.G. and Wolpoff, M.H., The multiregional evolution of humans, *Scientific American* **266**:76–83, 1992.
37. Hawks, ref. 35, p. 21.
38. Webb, S.G., *The First Boat People*, Cambridge University Press, Cambridge, UK, p. 198, 2006.
39. Webb, ref. 38, pp. 194–208.
40. Webb, ref. 38, pp. 273–274.
41. Flood, J., ref. 32, p. 69.
42. Wolpoff, M.H., Hawks, J., Frayer, D.W., and Hunley, K., Modern human ancestry at the peripheries: a test of the Replacement Theory, *Science* **291**:294, 2001.
43. Wolpoff *et al*., ref. 42, pp. 294–296.
44. Stringer, C. and Andrews, P., *The Complete World of Human Evolution*, 2nd edn, Thames & Hudson, London, pp. 142–143, 2011.
45. Barras, C., Ancient skull from China may rewrite our origins, *New Scientist* **236**(3152):9, 18 November 2017.
46. Stringer and Andrews, ref. 44, p. 143.
47. Bae, C.J., Douka, K., and Petraglia, M.D., On the origin of modern humans: Asian perspectives, *Science* **358**:eaai9067, pp. 3–4, 2017 | doi: 10.1126/science.aai9067.
48. Posth, C. *et al*., Deeply divergent archaic mitochondrial genome provides lower time boundary for African gene flow into Neanderthals, *Nature Communications* **8**:16046, pp. 2, 6, 2017 | doi:10.1038/ncomms16046.
49. Gibbons, A., Neandertals mated early with modern humans, *Science* **56**:14, 2017.
50. Posth *et al*., ref. 48, p. 5.
51. Hublin, J-J. *et al*., New fossils from Jebel Irhoud, Morocco and the pan-African origin of *Homo sapiens*, *Nature* **5**46:289–292, 2017. Richter, D. *et al*., The age of the hominin fossils from Jebel Irhoud, Morocco, and the origins of the Middle Stone Age, *Nature* **546**:293–296, 2017.
52. Hershkovitz, I. *et al*., The earliest modern humans outside Africa, *Science* **359**: 456, 458, 2018.
53. Hershkovitz *et al*., ref. 52, p. 456.
54. Thorne, A.G. and Wolpoff, M.H., The multiregional evolution of humans, *Scientific American* (special edn: updated from the April 1992 edn.) **13**(2): 46–47, 2003.
55. Thorne and Wolpoff, ref. 54, pp. 46–47, 52.
56. Klein, R.G., *The Human Career; Human biological and cultural,* 3rd edn, The University of Chicago Press, Chicago, IL, p. 629, 2009.
57. Wieland, C., *One Human Family: The Bible, science, race and culture*, Creation Ministries International, GA, pp. 170–171, 2011.
58. Line, P., Explaining robust humans, *J. Creation* **27**(3):64–71, 2013.
59. Wieland, C., Decreased lifespans: have we been looking in the right place? *J. Creation* **8**:140, 1994.
60. Interestingly, some multiregionalists like Alan Thorne and Milford Wolpoff have, while they are evolutionists and believe that the robust features of e.g. *Homo erectus* were earlier than the gracile ones of *Homo sapiens*, also argued that specimens like *Homo erectus* should be renamed *Homo sapiens*. See: Wolpoff, M.H., Thorne, A.G., Jelinek, J., and Yinyun, Z., The Case for sinking *Homo erectus*, 100 years of *Pithecanthropus* is Enough!; in: Jens, L.F. (Ed.), *100 Years of Pithecanthropus: The Homo erectus Problem*, Frankfurt am Main, *Courier Forschungs-Institut Senckenberg* **171**:341–361, 1994.
61. We saw earlier that OoA proponents would also tend to oppose the idea that robust Australian skulls, like Kow Swamp 1 and WLH 50, are *Homo erectus*, because they 'date' as later on the evolutionary scale than some gracile Australian specimens, and also because they believe *Homo erectus* did not have the intelligence to make well-built watercraft and navigate the open seas, which would be required to reach Australia.

Peter Line's *undergraduate major was in biophysics. After that, he completed a Masters Degree and a Ph.D., both in the area of neuroscience. He has had a keen interest in the creation/evolution issue ever since becoming a Christian, as evolution was a stumbling block to him believing God's Word was true.*

Accounting for blighting plant and disfiguring animal diseases

Warren Shipton

One of the most significant groups of microbes causing plant disease are the fungi. Plant pathogenic fungi appear to have arisen primarily from those growing on decaying organic matter and from those capable of growing inside plants. Many of the species found inside plants either do not hinder growth or exert positive effects. In the natural environment, non-pathogenic fungi are subjected to changes in biological balance, stress, and alterations of the genetic fabric through mutations, faulty duplication events, limited gene transfer, and other phenomena. Such features appear to account generally for the emergence of pathogens from among previously non-pathogenic representatives. By contrast, few fungi are capable of causing mammalian disease. When they do, it is mainly as a result of gaining access through wounds, on account of environmental changes, or occurs when animals are weakened through stress or the immune system is down-regulated. The few fungi capable of causing disease in healthy individuals are infected mainly through inhalation of dust aerosols. It is difficult to imagine that dusty conditions existed in the Garden of Eden (Delight).

Many are aware of diseases of plants. For example, brown spots appear on the delicate rose blossoms as we are beginning to admire their beauty. Oranges begin to rot in our storage containers before we manage to eat them. Dirty black spots appear on the leaves of magnificent kangaroo paw plants. Fungal diseases of humans are relatively rare. However, those causing tinea or athlete's foot and thrush (*Candida*) can be common.[1] Some of the infections appearing on humans are disfiguring, such as basidiobolomycosis and paracoccidioidomycosis.

Many of the common diseases of plants are caused by fungi, the microscopic and classically thread-like organisms that are abundantly present in decaying organic debris in the soil. In a somewhat more complex form, we know them as mushrooms. A number of fungi form close relationships with plant roots and other living surfaces. Others actually penetrate plant cells or form networks of microscopic threads between the cells. Within this group of organisms, there is a developed ability to penetrate plants, which is significant to our discussion.

The useful and cooperative abilities displayed by fungi have been altered and fungi are now capable of causing many plant and some human diseases.

Fungal relationships with plants

The number of accepted fungal species is around 120,000,[2] but only a small proportion of these are pathogenic. Those that are pathogenic are often closely related to non-pathogenic species. In fact, many of the genes identified in pathogenic fungi contribute to metabolic pathways found in all fungal species. Components of metabolic pathways regulating morphological and metabolic changes in response to stress and other external stimuli in non-pathogenic fungi are utilized in pathogenic fungi to regulate morphological and other changes associated with infection. In addition, those genes encoding enzymes capable of degrading plant cell walls or involved in forming infection structures are shared with saprophytes indicating a possible derivation from these fungi.[3] However, there are several groups of proteins that are over-represented in plant pathogens that may have been the product of gene duplication and further changes.[4] Certainly, variation in ploidy levels is known among selected plant and animal pathogens. Such changes may influence the expression of genes.[5]

The majority of fungi decompose organic debris (plant and otherwise) and live in close association with plant roots or on aerial plant surfaces. A surprising number of species have more intimate relationships with plants other than being pathogens. The mycorrhizal fungi (mutualists) invade plant roots to benefit their growth and confer resistance to pathogenic attack by select microbes (figure 1). Others grow mainly between cells without apparent effects on the operation of the host plant (endophytes). There is another group of fungi that grow on aerial surfaces (epiphytes) and live on the excretions and waste produced by sap-feeding insects.[6] A small number of fungi among those found on aerial surfaces gain their nourishment from the plant through special intracellular feeding devices (haustoria) and are considered pathogens. While the compartmentalisation into categories, as suggested, is used for convenience of discussion, it should be understood that interactions between plants and microbes really operate on a continuum. Indeed, examples can be found where some mycorrhizal fungi can obtain some of their energy through the breakdown of organic matter and some wood-rotting fungi can form structures

similar to those formed by genuine mycorrhizal fungi when they come in contact with roots.[7]

Many fungi infect plants, but do not produce symptoms. A considerable group found in this category are termed endophytes. Members typically live between the plant cells, but some may also penetrate cells. They may be highly localized in a plant or be systemic. It has been suggested that all plant species (vascular and non-vascular) possess such invaders and they may exceed a million species. When the plant is weakened by unfavourable climatic and other conditions, disease may develop. In favourable conditions, the endophytes have variable impacts on their hosts, but many appear to be beneficial. Those found in forage grasses may hasten seed germination, improve seed production and the defence and stress enduring capabilities of the plant, but the interactions are complex and depend very much on the strain of fungus and host involved. In some instances seed production is inhibited and infected plants resort to vegetative reproduction. In hosts other than forage grasses, additional benefits have been observed, such as improved nutrient uptake, expansion of the root system and subsequent increases in biomass and shoot growth, stimulation of the plant defences against pathogens, and increased stress tolerance.[8]

Whether an endophyte continues to grow without producing obvious symptoms in a plant depends on many factors including the developmental stage of both the host and fungus, the genetic capabilities of the fungus to cause disease and the plant to mount defences, and the environmental conditions prevailing. This means that plants placed under conditions of stress may be weakened, at which point the resident fungus may cause disease symptoms. For example, a strain of *Leptosphaeria maculans* isolated from the natural environment may subsequently cause disease in the same plant (*Arabidopsis*) under stressed laboratory conditions. There are a number of examples of changes in climatic conditions generating a switch to a pathogenic mode of operation where plant tissues are killed. Frequently endophytes become pathogenic following the senescence of tissues.[9]

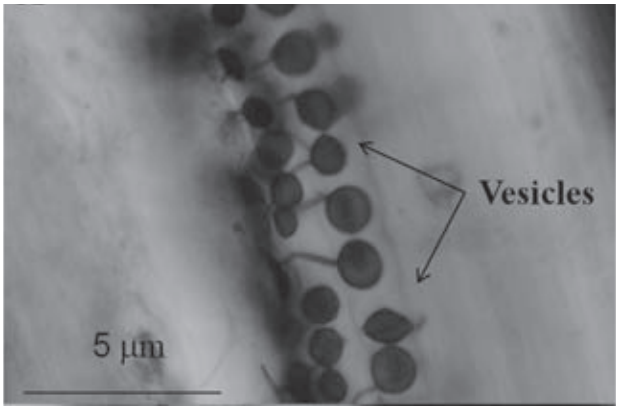

Figure 1. Arbuscular mycorrhizal structures in the desert annual plant, *Ceratocarpus* (from Zhang *et al.*[56])

The ability of fungi to live as an endophyte or mutualist involves eliciting a balanced response by the host plant to the presence of the organisms in its tissues. It is known that both endophytes and parasites use similar mechanisms of host recognition, but subsequent poorly understood biochemical features enable a friendly or unfriendly host response. It is known that a range of enzymes are released by endophytes that are capable of degrading organic components and aiding in infection. Why the enzymes and the toxins often produced do not cause disease is largely unknown, but the outcome seems to be related to the fine balance achieved between host defence reactions and fungus virulence factors.[10] Potential pathogens among endophytes also may be held in check by special viruses that dampen their ability to be pathogens. Many of these viruses do not cause disease among the fungal isolates.[11]

In the classical evolutionary scheme of thinking, endophytes are commonly considered to have arisen from plant parasites.[12] However, it is possible to conceive of an endophyte to parasite transition. I have adopted the latter scheme to account for some plant pathogens. This suggested pathway is based on the observed benefits often conferred on the host plant by endophytic microbial inhabitants. These benefits involve pathogen resistance, defence against herbivory, providing deterrents to seed predation, increasing plant competitive abilities and conferring stress resistance.[13] Endophyte groups have family relatives that are well known degraders of organic debris, nematode-trapping fungi, and insect and plant pathogens (including rusts and smuts).[14] Known pathogenic species have been identified as endophytes elsewhere, and as such do not cause any symptoms of infection.[15] Indeed, one of the peculiarities of these organisms is that under certain circumstances endophytes may become pathogens or even *vice versa*, and a fungus endophytic with one plant may be pathogenic on another.[10] Such changes commonly follow environmental stress.

The outcome of the interaction can be altered by endophytic and mycorrhizal fungi themselves being colonized by bacteria. These bacteria may have significant influences on the growth and fungal development before host infection takes place.[16] One bacterium sometimes found in the hyphae of a mycorrhizal-like/endophytic fungus is *Agrobacterium tumefaciens*. The bacterium has growth-promoting influences and may function to enable the plant to be resistant to plant pathogens including epiphyte pathogens.[17]

Those fungi that operate regularly as plant pathogens release proteins into the environment, facilitating their ability to invade. The numbers of such proteins in the majority of pathogens is similar to that shown by fungi growing

on organic debris. Those that are dedicated to keeping the host cells alive for the greatest period of time (e.g. obligate pathogens) generally have fewer secreted proteins to reflect their special relationship with plants, although there are exceptions.[18]

Obligate plant-inhabiting fungi

Some fungi are unable to live apart from plants and others have a limited existence outside plants. The former group includes organisms that damage (pathogens). Besides the pathogenic fungi of aerial plant parts such as rusts and mildews, there is a considerable group of beneficial mycorrhizal fungi that invade roots. Many are limited in their saprophytic ability and normally cannot complete their life cycle independent of plants. The mycorrhizal fungi usually confer benefits on the plants they colonise, but, under some conditions, they may become parasitic and reduce growth. Hence, again it is very much a case of maintaining a balanced relationship that determines whether an organism is considered a mutualist or a pathogen.[7,19]

If we take very specialized groups of pathogens such as the powdery mildews and rusts, some interesting findings emerge. These organisms do not have an existence except as pathogens, thus they are termed obligate. In comparison to other fungi, they show a loss of certain biosynthetic pathways making it difficult, if not impossible, to culture them apart from a host plant. During the early stages of growth on a plant, some of the fungi (rusts) may be symptomless, essentially acting as endophytes. They gain their nourishment by growing intercellularly and producing special structures inside cells (haustoria).[20] By contrast, the powdery mildews grow on aerial plant surfaces and obtain their nourishment intracellularly by means of haustoria (figure 2). It seems entirely possible for the organisms we now term obligate pathogens to have enjoyed a more balanced existence in the past where limited fungal growth in or on the plant led to sparse numbers of spores being formed. Conceivably, in the past, they might have possessed greater abilities for independent living, as genetic analysis can be taken to indicate. Their possession of intracellular feeding structures is shared by a small number of beneficial fungi (endophytes),[9,18] hence strengthening the general argument in favour of a more balanced lifestyle in the past.

How this might have functioned is illustrated by two examples. The first is that systemic resistance to some powdery mildews is induced when a mycorrhizal-like fungus invades plant tissues. This only occurs when the invading fungus carries a specific bacterium (*Agrobacterium*) in its hyphae.[17] The second example relates to a serious maize plant pathogen (*Ustilago maydis*), which does not fit into the obligate pathogen category, but nevertheless is not easy to cultivate. This organism can show symptoms in all the above-ground parts of the plant. If the major genes enabling colonization are silenced, then the fungus acts as an endophyte but is still able to complete its life cycle with the late production of spores.[21]

Plants possess complex defence mechanisms preventing invasion by unwanted microorganisms. Proteins are secreted by would-be pathogens. If these are recognized by resistant plants, then no invasion takes place, as the plant defences are activated. On the other hand, if the genes in the plant or microbe are altered, then the plant may be colonized by the microbe. Retrotransposons may give rise to changed proteins, which influence the microbe's (including epiphytic species') ability to invade.[22]

Plant and fungal genomes

Plants are designed to sense the presence of microbes that colonize them and this includes would-be pathogens. They have receptor molecules on cell surfaces that detect molecular patterns associated with microbes, which then stimulate the plant to mount a defence against the invader. Molecules released on account of microbial invasion also may stimulate defence mechanisms. The genetic systems of both plants and plant pathogens are finely balanced. The plant continually attempts to maintain its genetic integrity that enables it to be resistant, as through changing receptor characteristics. On the other hand, the microbe continually attempts to breach this barrier through such mechanisms as mutation, changes in the number and location of transposable elements, and loss of genes and other phenomena.[18,23] The involvement of gene duplication and diversification being involved is strongly supported by the experimental data. Evidence for gene transfer is suggested mainly by comparative studies on gene sequences, but there are well-researched examples of bacterial DNA being integrated into host plant DNA (field) and bacterial DNA into yeasts and filamentous fungi (laboratory).[24]

Many of the plant pathogenic fungi sequenced have larger genomes than their closest non-pathogenic relatives. There are fungi with expanded genomes on account of possessing repetitive transposable elements, such as in *Leptosphaeria maculans* (which causes a stem disease in crucifers). Others appear to have lost genes and introns and have reduced transposon content. Some of the variations associated with pathogenic fitness may be generated through imprecision in the operation of repeat-induced point mutation machinery.[3,25]

The genome size of the pathogenic barley powdery mildew (*Blumeria*) again is larger than other related ascomycetes, but gene numbers are low in comparison to other fungal genomes. Genes commonly present in other filamentous fungi were absent in this and other powdery mildews. The number of transposable elements identified accounted for a sizeable 64% of the genome size. The increase in genome size and

over-abundance of transposable elements (retrotransposons) appeared due to the absence of a repair pathway (repeat induced mutation), which also could be responsible for gene loss and reassortment of genetic information. It is postulated that the gene loss could have been responsible for these fungi becoming completely dependent on living cells for their existence. The mildew pathogens are among a group of fungi that avoid killing the plant cells. It is not surprising, then, that they produced a low number of secondary metabolites, which is a common feature in such pathogens. They also possessed a much reduced set of enzymes capable of degrading plant cell wall components.[26]

Single gene changes may enable a parasite to act as an endophyte and *vice versa*. This has been demonstrated experimentally with a pathogen of cucumbers (*Colletotrichum magna*) and an endophyte of ryegrass (*Epichloë festucae*). In the latter instance, mutation in a gene enabled the harmless endophyte colonist to cause severe plant stunting and death.[10,27] It is also possible that gene changes in a pathogen may enable strong plant defences to be mounted, rendering the pathogen less effective in that role. In mutualistic fungi, underexpression of a particular gene may promote mycorrhizal infection while overexpression may impair it.[18]

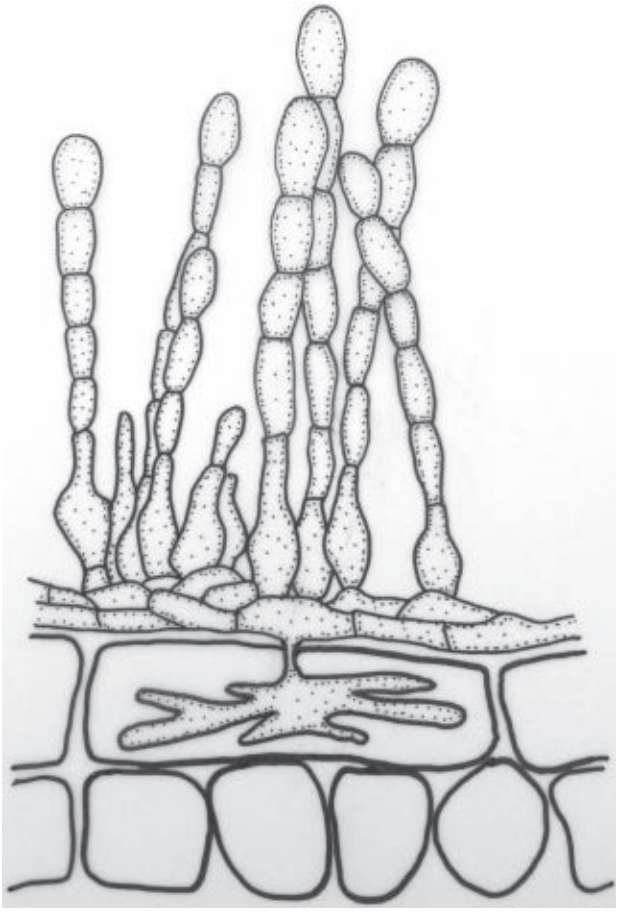

Figure 2. Illustration of a powdery mildew fungus growing epiphytically on the surface of a leaf and producing abundant spores (conidia). The organism gains nourishment through haustoria located in the epidermal cells. One complete epidermal cell containing a haustorium is shown.

The genetic information capable of enabling a fungus to cause disease may be carried by the organism, but may be silenced by other microbes associated with it. This has been rather convincingly shown with a soil-borne pathogen of lettuce. When closely associated bacteria were removed from the hyphae of a *Fusarium* fungus, it became pathogenic. This means that the associated bacteria were able to silence the expression of the fungal genes responsible for disease.[28]

Transfer of genetic information

Fungi are commonly filamentous organisms. The filaments are termed hyphae that originate often from vegetative cells, giving rise first to germ tubes and then hyphae. Those with the right genetic makeup may produce germ tubes that fuse (anastomose) to form a common structure that contains the genetic material possessed by both representatives in a common environment (hypha).

The significance of this phenomenon of anastomosis to form heterokaryons or dikaryons has been studied over a long period and confers abilities for adaptation on the new hypha produced as a result of both the fusion and subsequent events.[29] The new hypha understandably contain nuclei from both contributing spores and may confer new abilities. One unusual consequence of such a fusion may be the appearance of enhanced disease expression, as illustrated in the following example. A disease of cereals (tan spot) that was first noticed around 80 years ago appears to be the result of transfer of a toxin gene (toxA) from one plant pathogen (*Stagnospora nodorum* on wheat) to a mild pathogen (*Pyrenophora tritici-repentis*—yellow spot fungus on wheat) resulting in the emergence of a new and devastating disease. The original disease organisms can infect the same leaf, leaving the opportunity for hyphal fusion to take place. Although the relevant experiments have not yet been performed to show that fusion can occur between these two species, the DNA similarity between the species is strong and both are known to possess the capacity to anastomose.[30] In related situations, it has been shown that whole chromosome transfer can occur between related fungi, under the right circumstances, even between those that are usually considered incompatible. Such transfer may enable non-pathogenic isolates of a particular fungus to become pathogenic. Hybrids may also form between different fungal species, when they are mixed in culture, to produce offspring that have an extended host range.[31] Indeed, the transfer of material between seemingly incompatible fungi can be made possible by manipulating the chemical environment surrounding hyphae. Resulting

anastomoses also allowed for the transmission of viruses between species of very different backgrounds.[32]

Genes and chromosome segments or even whole chromosomes may be transferred among fungal isolates and species via anastomoses involving hyphae or special protuberances arising from spores. Such fusions can occur on the host surface or in reproductive structures on the host.[33]

The transfer of plasmids may occur between parasitic fungi and their fungal host and between unrelated fungi that usually occupy the same ecological niche. Plasmid transfer between unrelated fungi is presumably through a temporary hyphal fusion.[34] Of perhaps greater fascination is the transfer of DNA between bacteria and yeast (classical single-celled fungi) facilitated by conjugative plasmids. This appears to involve a conjugation process where a thin extension develops from the bacterium and fuses with the recipient yeast cell.[35] It has been suggested, on the basis of gene homology, that toxin genes found in *Photorhabdus* (a bacterium symbiont in selected nematodes) have been involved in horizontal transfer to the endosymbiotic fungus *Epichloë*. In some bacteria, the toxin genes are plasmid-borne, making such a suggestion a real possibility.[36] Mechanisms for such transfer have been identified in general terms and involve the formation of conjugation-type structures in interactions between bacteria and eukaryotes (plants, yeasts, filamentous fungi, and diatoms). Bacteria-plant transfers have been shown to occur in nature and bacterium-to-yeast transfer occurs in situations close to those encountered in the natural environment. In the plant-bacterium transfers, the donor DNA can be integrated into the recipient genome.[24,37]

Of interest also is the possible function of exosomes (cell-derived vesicles) in the transport of RNA. In powdery mildew infections (figure 2), exosomes may accumulate at contact sites with the plant. In other systems, micro-RNA components can be exchanged and induce gene silencing. With the mildew fungus *Blumeria graminis*, there is some evidence that trafficking of RNA occurs from the host to the fungus leading to silencing of genes in the fungus, which may translate into reduced haustorium formation. The phenomenon is being investigated as a means to control plant disease and has been shown to be successful with the rust fungus *Puccinia tricticina*.[38] This mechanism potentially is highly significant in explaining the postulated altered interactions of powdery mildews and rusts since the beginning.

Intact yeast cells are also able to take up exogenous DNA (plasmid) via transformation. The plasmid DNA subsequently taken from the yeast was then capable of being reincorporated into bacteria. It is conceivable, but not proven, that conditions suitable for such transformation events could exist naturally in the environment.[39] Transfer of plasmids between yeast species also has been shown experimentally, although the mechanism is not understood.[40] This is an area of investigation that is worth watching closely.

The movement of genetic material from one organism to another can occur in the natural environment. This may be limited. Bacteria can be transformed in the natural environment by DNA from plants and other sources, if sufficient homology is present,[41] and they in turn can donate bacterial DNA to fungi when the organisms are co-cultivated in the laboratory.[42] The question might be asked whether there are bacteria present in soils that can act as a shuttle to pass genes between sources. The answer appears to be that such bacteria do exist, as illustrated below. A considerable group of fungi can form associations with and attachments to the soil bacterium *Agrobacterium*. In one well-executed study, attachment was confirmed by electron microscope. This enabled gene and plasmid transfer to take place and such transfer was confirmed by further analysis. Association between fungi and *Agrobacterium* in the soil environment and active gene transfer there is a possibility as this is the natural environment for both the bacterium and many fungi.[43] Again, this is an area of investigation that might be followed closely, for it has significant implications. Readers might consider that bacteria other than *Agrobacterium* are capable of transferring DNA to plants, which can integrate into the genome and express its presence through bacterial enzyme activity.[44]

More distantly related to the transfer of genetic information is the phenomenon of one microbe invading another and enabling the consortium to become disease-producing. For example, a fungus (*Rhizopus*) pathogenic on rice seedlings has been shown to be invasive solely due to the presence of a bacterium (*Burkholderia*) in its hyphae. The bacterium produces a toxin which contributes significantly to the disease process.[45]

Fungal relationships with animals

The vast majority of fungi, and particularly those pathogenic to humans, can live a life independent of parasitism. They usually are harmless organisms found on or in the mammalian body or live on organic debris breaking it down into simpler forms. This means that changes in the animal host and environment are critical to their ability to infect.

A number of fungi are carried on or in the human body as harmless organisms, such as *Candida albicans*. If the biological balance existing between these organisms and the multitude of other microbes is upset, such as by antibiotic and chemotherapy treatments, illness, pregnancy, and other events, the organism can increase its population levels dramatically and cause disease. Among human beings, there are a number of developments that have occurred to account for increased host susceptibility and the upsurge in diseases

caused by fungi. One significant factor is the large number of newly susceptible hosts produced by the burgeoning number of diabetic and AIDS patients.[46]

A second group of factors contributing to disease are adaptations in the microbe enabling it to accommodate to changing environments and become pathogenic. Virulence attributes (relative capacity to damage the host) can be thought of as factors that increase the ability of the organism to survive and colonize the mammalian host, but which are not essential for growth of the parasitic stage *in vitro*.[47]

The final group of factors that contributes to the emergence of disease is the existence of suitable environmental conditions. Virulent microbes and susceptible hosts may be in constant contact, but if the environmental conditions are unsuitable, disease will not develop. Good illustrations of this phenomenon are the common occurrence of *Candida* and *Pneumocystis* in the healthy human organism without causing disease. The environment may change when the immune system becomes less robust or the homeostatic status is altered through drug and other manipulations. It is then that disease develops.

A small number of fungi are able to cause disease in apparently healthy individuals (primary systemic pathogens—figure 3). These fungi enter the body through inhalation of aerosolized fragments of the organisms and their spores on account of disturbances in the environment. Other primary pathogens (not systemic but able to infect healthy people) may invade the subcutaneous tissues through a breach in the skin barrier.[48] Species placed in the systemic group respond to the change of temperature in the mammalian body and switch from a filamentous to a yeast form of growth. This change enables the expression of genes that confer the ability to become pathogens in the animal body.[49] In one pathogen (*Histoplasma*), the switch is regulated by a protein that is expressed at a higher level at animal body temperature.[50] What role the genes responsible for such pathogenic ability play in the natural environment is not always understood. In the case of the pigment melanin or melanin-like pigments, which are produced by *Histoplasma* and other important human pathogens,[51] their role is appreciated. In the natural environment melanin confers significant protection against damage to nucleic acid by ultraviolet light in a range of organisms.[52] With *Cryptococcus*, capsule formation is a significant virulence determinant. In the natural environment, it appears the capsule protects the yeast from damaging bacteria.[53]

Figure 3. Disfiguring and serious infection by the primary systemic pathogenic fungus *Paracoccidioides brasiliensis*

With the primary systemic pathogens, most depend for dispersal and intake into the mammalian body on the production of dust aerosols containing fungal elements, which are inhaled. In the pleasant environment described in the first two chapters of Genesis (a beautiful garden watered by a river and mist—2:6, 10), dust aerosols appear unlikely to have been produced. The human couple were to tend and keep God's special creation (v. 15), not till and work the estate. However, once outside the Garden of Eden, and under the curse of sin, the soil was worked and thorns and thistles appeared (chapter 3:17–19), and the impact of climate change possibly was felt (Adam was destined to eat bread while sweating). Under these altered circumstances, organisms performing useful functions may have been given the opportunity to develop other abilities.

The appearance of pathogenic fungi on mammals is a result of changes in host, the microbe, and the environment. Stress and climatic changes, the occurrence of lifestyle diseases, accidents, complex surgical procedures, and imbalance observed in gene duplication and movement and other events all have played a part in the increasing significance of this group of microbes as pathogens.

Conclusion

When primary fungal pathogens, commensals, and opportunists are compared, there are few substantial differences in the features displayed. Each organism possesses a unique combination of factors (virulence composite) that enables it to be a successful colonist.[54] The data available simply highlight the limitations in our knowledge and also illustrate that virulence genes vary in their significance depending on the strain and the host involved. A critical number of genes ultimately are necessary for the organism to cause disease. However, the gene-set necessary may change depending on the immune status of the host, on the site in the host encountered, and the form of the inoculum involved.[55]

The majority of fungi exist in the environment (terrestrial and aquatic) as decay agents of organic debris or form helpful associations with plants and animals. The change of activities from cooperative to destructive ones endangering life is ultimately a consequence of human disregard for God's

instructions and the search for an alternative philosophy of life. All nature has suffered the consequences. As a result of this deliberate choice by humanity, stress and dysfunction entered the world with widespread and unplanned destruction of life.

Several responses of fungi to these altered circumstances have been noted. Plants exposed to environmental and other stresses have been rendered variously susceptible to members of the fungal microbiota normally involved in the breakdown of organic debris. Those members devoted to living in harmony with plants or delivering benefits can also respond to the altered conditions by becoming pathogens. This transition can be easy, as the microbes already have well-versed systems that allow plant entry and a means of obtaining nutrients. In addition, plants and microbes are susceptible to changes in genome composition on account of mistakes in copying and movement of genes or gene segments within the genome.

Particularly with plant-invading fungi, changes to the genetic characteristics displayed can be accounted for by mutations, mismatch repair mistakes, parasexual phenomena, exchanges of genetic materials among fungi, or donations of DNA received from members of microbiota and others. The extent of acquisition of genetic information from alien sources is unknown, but there are well-established mechanisms for transfer including hyphal fusion, conjugation, and transformation.

The existence of obligate pathogens is the most difficult to explain. At least with one major group (powdery mildews) some useful information is available. They show a massive increase in the number of transposable elements, reassortment of genetic information with gene loss, and changes in transport of RNA from host to fungus. Such changes help to explain the current existence of a less-balanced relationship to the one that supposedly existed for this group of fungi in the distant past. The picture will undoubtedly clarify as more information is gathered.

Animals are susceptible to a small number of fungal pathogens. The majority enter through wounds and other portals made susceptible through environmental changes. The carriage of microbial spores and fragments in aerosols is an effective method of introducing unwelcome aliens into the body. As with plants, changes in both potential hosts and in the microbe may predispose to invasion and disease. The emergence of animal diseases can be explained, almost entirely, by invoking well-known nature- and human-induced phenomena.

References

1. Johnson, J., What we need to know about fungal infections, *MedicalNewsToday*, 17 June 2017, medicalnewstoday.com/articles/317970.php.
2. Hawksworth, D.L. and Lücking, R., Fungal diversity revisited: 2.2 to 3.8 million species, *Microbiology Spectrum* **5**(4), 2017 | doi:10.1128/microbiolspec.FUNK-0052-2016.
3. Rouxel, T., Grandaubert, J., Hane, J.K. *et al*., Effector diversification within compartments of the *Leptosphaeria maculans* genome affected by repeat-induced point mutations, *Nature Communications* **2**, article 202, 2011 | doi:10.1038/ncomms1189.
4. Soanes, D.N., Alam, I., Cornell, M. *et al*., Comparative genome analysis of filamentous fungi reveals gene family expansions associated with fungal pathogenesis, *Plos One* **3**:1–15, 2008 | doi.org/10.1371/journal.pone.0002300
5. Todd, R.T., Forche, A., and Selmecki, A., Ploidy variation in fungi—Polyploidy, aneuploidy, and genome evolution, *Microbiology Spectrum* **5**(4), 2017 | doi:10.1128/microbiolspec.FUNK-0051-2016
6. Chomnunti, P., Hongsanan, S., Aguirre-Hudson, B. *et al*., The sooty moulds, *Fungal Diversity* **66**:1–36, 2014.
7. Koide, R.T., Sharda, J.N., Herr, J.R. *et al*., Ectomycorrhizal fungi and the biotrophy-saprotrophy continuum, *New Phytologist* **178**(2):230–233, 2008.
8. Clay, K., Fungal endophytes of grasses, *Annual Review of Ecology and Systematics* **21**:275–297, 1990; García-Guzmán, G. and Heil, M., Life histories of hosts and pathogens predict patterns in tropical fungal plant diseases, *New Phytologist* **201**:1106–1120, 2014; Hamilton, C.E., Gundel, P.E., and Saikkonen, H.K., Endophytic mediation of reactive oxygen species and antioxidant activity in plants: a review, *Fungal Diversity* **54**(1):1–10, 2012; Navarro-Melendez, A.L. and Heil, M., Symptomless endophytic fungi suppress endogenous levels of salicyclic acid and interact with the jasmonate-dependent indirect defense traits of their host, lima bean (*Phaseolus lunatus*), *J. Chemical Ecology* **40**:816–825, 2014; Schulz, B. and Boyle, C., The endophytic continuum, *Mycological Research* **109**(6):661–686, 2005.
9. DeLaye, L., García-Guzmán, G., and Heil, M., Endophytes versus biotrophic and necrotrophic pathogens—are fungal lifestyles evolutionarily stable traits? *Fungal Diversity* **60**:125–135, 2013; Schulz and Boyle, ref. 8.
10. Kogel, K-H., Franken, P., and Hückelhoven, R., Endophyte or parasite—what decides? *Current Opinion in Plant Biology* **9**(4):358–363, 2006; Schulz and Boyle, ref. 8.
11. Kobayashi, D.Y. and Hillman, B.I., Fungi, bacteria, and viruses as pathogens of the fungal community; in: Dighton, J., White, J.F., and Oudemans, P. (Eds.), *The Fungal Community: Its organization and role in the ecosystem*, 3rd edn, Taylor and Francis, Boca Raton, FL, pp. 399–422, 2005.
12. Clay, K. and Schardl, C., Evolutionary origins and ecological consequences of endophyte symbiosis with grasses, *American Naturalist* **160**(suppl.):S99–S127, 2002.
13. Saikkonen, K., Faeth, S.H., and Helander, M. *et al*., Fungal endophytes: a continuum of interactions with host plants, *Annual Review of Ecology and Systematics* **29**:319–343, 1998 | doi:10.1146/annurev.ecolsys.29.1.319.
14. Rodriguez, R.J., White Jr, J.F., Arnold, A.E. *et al*., Fungal endophytes: diversity and functional roles, *New Phytologist* **182**(2):314–330, 2009.
15. Pan, J.J., Baumgarten, A.M., and May, G., Effects of host plant environment and *Ustilago maydis* infection on the fungal endophyte community of maize (*Zea mays*), *New Phytologist* **178**(1):147–156, 2008.
16. Hoffman, M.T. and Arnold, A.E., Diverse bacteria inhabit living hyphae of phylogenetically diverse fungal endophytes, *Applied and Environmental Microbiology* **75**(12):4063–4075, 2010.
17. Bonfante, P. and Anca, I-A., Plants, mycorrhizal fungi, and bacteria: a network of interactions, *Annual Review of Microbiology* **63**:363–383, 2009.
18. Presti, L.L., Lanver, D., Schweizer, G. *et al*., Fungal effectors and plant susceptibility, *Annual Review of Plant Biology* **66**:513–545, 2015.
19. Brundett, M., Diversity and classification of mycorrhizal associations, *Biological Reviews* **79**(3):473–495, 2004.
20. Kemen, E. and Jones, J.D.G., Obligate biotroph parasitism: can we link genomes to lifestyle? *Trends in Plant Science* **17**(8):448–457, 2012.
21. Brefort, T., Tanaka, S., Neidig, N. *et al*., Characterization of the largest effector gene cluster of *Ustilago maydis*, *Plos Pathogens* **10**(7):e1003866, 2014 | doi:10.1371/journal.ppat.1003866.
22. Amselem, J., Vigouroux, M., Oberhaensli, S. *et al*., Evolution of the *EKA* family of powdery mildew avirulence-effector genes from the ORF 1 of a LINE retrotransposon, *BMC Genomics* **16**:917, 2015 | doi**:**10.1186/s12864-015-2185-x.
23. de Jonge, R., van Esse, H.P., Maruthachalam, K. *et al*., Tomato immune receptor Ve1 recognizes effector of multiple fungal pathogens uncovered by genome and RNA sequencing, *PNAS* **109**(13):5110–5115, 2012; Dodds, P.N. and Rathjen, J.P., Plant immunity: towards an integrated view of plant-pathogen interactions, *Nature Reviews Genetics* **11**(8):539–548, 2010; Stergiopoulos, I. and de Wit, P.J., Fungal effector proteins, *Annual Review of Phytopathology* **47**:233–263, 2009.

24. Lacroix, B., Tzfira, T., Vainstein, A. *et al*., A case of promiscuity: *Agrobacterium*'s endless hunt for new partners, *Trends in Genetics* **22**(1):29–37, 2006; Lacroix, B., Citovsky, V., Winans, S.C. *et al*., Transfer of DNA from bacteria to eukaryotes, *mBio* **7**(4):e00863-16, 2016, mbio.asm.org/content/7/4/e00863-16.full.
25. Raffaele S. and Kamoun S., Genome evolution in filamentous plant pathogens: why bigger can be better, *Nature Reviews Microbiology* **10**(6):417–430, 2012 | doi:10.1038/nrmicro2790.
26. Spanu, P.D., Abbott, J.C., Amselem, J. *et al*., Genome expansion and gene loss in powdery mildew fungi reveal tradeoffs in extreme parasitism, *Science* **330**(6010):1543–1546, 2010.
27. Tanaka, A., Christensen, M.J., Takemoto, D. *et al*., Reactive oxygen species play a role in regulating a fungus–perennial ryegrass mutualistic interaction, *Plant Cell* **18**(4):1052–1066, 2006.
28. Minerdi, D., Moretti, M., Gilardi, G. *et al*., Bacterial ectosymbionts and virulence silencing in a *Fusarium oxysporum* strain, *Environmental Microbiology* **10**(7):1725–1741, 2008.
29. Shipton, W.A., *The Biology of Fungi Impacting Human Health*, Trafford, Singapore, pp. 94–96, 2012.
30. Friesen, T.L., Stukenbrock, E.H., Liu, Z. *et al*., Emergence of a new disease as a result of interspecific virulence gene transfer, *Nature Genetics* **38**:953–956, 2006.
31. Ma, L.J., van der Does, H.C., Borkovich, K.A. *et al*., Comparative genomics reveals mobile pathogenicity chromosomes in *Fusarium*, *Nature* **464**(7278):367–373, 2010; Mehrabi, R., Bahkali, A.H., Abd-Elsalam, K.A. *et al*., Horizontal gene and chromosome transfer in plant pathogenic fungi affecting host range, *FEMS Microbiology Reviews* **35**(3):542–554, 2011.
32. Ikeda, K., Inoue, K., Kida, C. *et al*., Potentiation of mycovirus transmission by zinc compounds via attenuation of heterogenic incompatibility in *Rosellinia necatrix*, *Applied and Environmental Microbiology* **79**(12):3684–3691, 2012.
33. Mehrabi *et al*., ref. 31.
34. Kempken, F., Horizontal transfer of a mitochondrial plasmid, *Molecular and General Genetics* **248**(1):89–94, 1995.
35. Heinemann, J.A. and Sprague, G.F., Bacterial conjugative plasmids mobilize DNA transfer between bacteria and yeast, *Nature* **340**(6230:205–209, 1989.
36. Han, J.E., Tang, K.F.J., Tran, L.H. *et al*., *Photorhabdus* insect-related (Pir) toxin-like genes in a plasmid of *Vibrio parahaemolyticus,* the causative agent of acute hepatopancreatic necrosis disease (AHPND) of shrimp, *Diseases of Aquatic Organisms* **113**(1):33–40, 2015 | doi:10.3354/dao02830; Ambrose, K.V., Koppenhöfer A.M., and Belanger, F.C., Horizontal gene transfer of a bacterial insect toxin gene into the *Epichloë* fungal symbionts of grasses, *Scientific Reports* **4**, article 5562, 2014 | doi:10.1038/srep05562.
37. Godio, R.P., Fouces, R., Gudina, E.J. *et al*., *Agrobacterium tumefaciens*-mediated transformation of the antitumor clavaric acid-producing basidiomycete *Hypholoma sublateritium*, *Current Genetics* **46**(5): 287–294, 2004.
38. Nowara. D., Gay, A., Lacomme, C. *et al*., HIGS: host-induced gene silencing in obligate biotrophic fungal pathogen *Blumeria graminis*, *Plant Cell* **22**(9):3130–3141, 2010; Valadi, H., Ekström, K., Bossios, A. *et al*., Exosome-mediated transfer of mRNAs and microRNAs is a novel mechanism of genetic exchange between cells, *Nature Cell Biology* **9**(6):654–659, 2007; Panwar, V., McCallum, B., and Bakkeren, G., Endogenous silencing of *Puccinia triticina* pathogenicity genes through in planta-expressed sequences leads to the suppression of rust diseases on wheat, *The Plant J.* **73**(3):521–532. 2013.
39. Nevoigt, E., Fassbender, A., and Stahl, U., Cells of the yeast *Saccharomyces cerevisiae* are transformable by DNA under non-artificial conditions, *Yeast* **16**(12):1107–1110, 2000.
40. Mentel, M., Špírek, M., Jørck-Ramberg, D. *et al*., Transfer of genetic material between pathogenic and food-borne yeasts, *Applied and Environmental Microbiology* **72**(7):5122–5125, 2006.
41. de Vries, J., Meier, P., and Wackernagel, W., The natural transformation of the soil bacteria *Pseudomonas stutzeri* and *Acinetobacter* sp. by transgenic plant DNA strictly depends on homologous sequences in the recipient cells, *FEMS Microbiology Letters* **195**:211–215, 2001; Marcet-Houben, M. and Gabaldón, T., Acquisition of prokaryotic genes by fungal genomes, *Trends in Genetics* **26**(1):5–8, 2009.
42. Sharma, K.S. and Kuhad, R.C., Genetic transformation of lignin degrading fungi facilitated by *Agrobacterium tumefaciens***,** *BMC Biotechnology* **10**:67, 2010 | doi**:**10.1186/1472-6750-10-67
43. Demanèche, S., Kay, E., Gourbière, F. *et al*., Natural transformation of *Pseudomonas fluorescens* and *Agrobacterium tumefaciens* in soil, *Applied and Environmental Microbiology* **67**(6):2617–2621, 2001; Sharma and Kuhad, ref. 42.
44. Broothaerts, W., Mitchell, H.J., Weir, B. *et al*., Gene transfer to plants by diverse species of bacteria, *Nature* **433**(7026):629–633, 2005.
45. Lackner, G., Möbius, N., Scherlach, K. *et al*., Global distribution and evolution of a toxinogenic *Burkholderia-Rhizopus* symbiosis, *Applied and Environmental Microbiology* **75**(9):2982–2986, 2009; Partida-Martinez, L.P. and Hertweck, C., Pathogenic fungus harbours endosymbiotic bacteria for toxin production, *Nature* **437**(7060):884–888, 2005.
46. Shipton, ref. 29, pp. 55–58.
47. Casadevall, A. and Pirofski, L., Host–pathogen interactions: the attributes of virulence. *J. Infectious Diseases* **184**(3):337–344, 2001; Rappleye, C.A. and Goldman, W.E., Defining virulence genes in dimorphic fungi, *Annual Review of Microbiology* **60**:281–303, 2006.
48. Reiss, E., Shadomy, H.J., and Marshall, G., *Fundamental Medical Mycology*, Wiley-Blackwell, Hoboken, NJ, pp. 14, 25–26, 2011.
49. Beyhan, S., Gutierrez, M., Voorhies, M. *et al*., A temperature-responsive network links cell shape and virulence traits in a primary fungal pathogen, *PloS Biology* **11**(7):e1001614, 2013 | doi:10.1371/journal.pbio.1001614.
50. Nguyen, V.Q. and Sil, A., Temperature-induced switch to the pathogenic yeast form of *Histoplasma capsulatum* requires Ryp1, a conserved transcriptional regulator, *PNAS* **105**(12):4880–4885, 2008.
51. Nosanchuk, J.D., Gómez, B.L., Youngchim, S. *et al*., *Histoplasma capsulatum* synthesizes melanin-like pigments in vitro and during mammalian infection, *Infection and Immunity* **70**(9):5124–5131, 2002.
52. Gauslaa, Y. and Solhaug, K.A., Fungal melanins as a sun screen for symbiotic green algae in the lichen *Lobaria pulmonaria*, *Oecologia* **126**:462–471, 2001; Ruan, L., Yu, Z., Fang, B. *et al*., Melanin pigment formation and increased UV resistance in *Bacillus thuringiensis* following high temperature induction, *Systematic and Applied Microbiology* **27**:286–289, 2004; Shipton, ref. 29, pp. 129–131.
53. Abdulkareem, A.F., Lee, H.H., Ahmadi, M. *et al*., Fungal serotype-differences in bacterial-yeast interactions, *Virulence* **6**(6):652–657, 2015 | doi:10.1080/21505594.2015.1066962.
54. Shipton, ref. 29, pp. 161–163.
55. Perfect, J.R., Genetic requirements for virulence in *Cryptococcus neoformans*; in; Domer J.E. and Kobayashi, G.S. (Eds.), *The Mycota XII: Human fungal pathogens,* Springer-Verlag, Heidelberg, pp. 89–112, 2004.
56. Zhang, T., Shi, N., Bai, D. *et al.*, Arbuscular mycorrhizal fungi promote the growth of *Ceratocarpus arenarius* (Chenopodiaceae) with no enhancement of phosphorus nutrition, *Plos One* **7**(9):e41151, 2012 | doi.org/10.1371/journal.pone.0041151.

Warren A. Shipton *received his B.Sc.Agr. (hons) in 1961 and a Ph.D. from the University of Sydney and subsequently an M.Ed. from James Cook University. He has published extensively in the biological sciences, including biomedical science. He is a Fellow of the Australian Society for Microbiology. He has published widely in professional journals, has been a dean of science at James Cook University and president of Asia-Pacific International University, Thailand, where he is a professor in the faculty of science.*

Family Araucariaceae—an 'icon' of evolution, but the storyline doesn't fit

Jaroslav Joseph Havel

Evolutionary theory presents the family Araucariaceae as being a group of dinosaur-age plants that are on a path to extinction because of competition from the 'more advanced' angiosperms. However, where there has been a decline in the geographic spread of Auracariaceae it is not due to them being 'primitive' (a false evolutionary concept), but due to the introduction of fire and the clearing of land for agriculture. The many examples of the family Araucariaceae's association with angiosperms, and that it has representatives occupying zones of extreme soils and temperatures, thwarts evolutionary tale-telling.

An evolutionary view of the Araucariaceae

Just as the evolutionary storyline posits that there was a golden age for the dinosaurs, so too in the plant world with the family Araucariaceae. One of its number, *Wollemia nobilis*, the Wollemi Pine, is even referred to as the 'dinosaur tree'.[1,2] And just as evolutionary theory says the dinosaurs came to be replaced by the mammals, so the Araucariaceae are often portrayed as 'primitive', 'relict' vegetation struggling to hold on against the rise of the flowering plants, the angiosperms.

An example of such a portrayal can be seen on the front and back covers of the proceedings of a major symposium held in Auckland, New Zealand, in 2002, which was published in 2009.[3] The front cover is dominated by a picture of a grove of *Araucaria araucana* from Argentina (figure 1). It is a stark picture of about a dozen trees growing on a bare outcrop of volcanic rock, without any understory other than a few dry tufts of grass among the rocks. The description of the grove is "Relict *Araucaria araucana* from Lonco Luan, Argentina", with the word 'relict' obviously intended to emphasize that the Araucarias are on their way out.

On the back cover, Araucariaceae are described as having somehow survived, from the age of the dinosaurs to the present day, against all odds.

The symposium was organized by the International Dendrology Society, which was celebrating the 50th anniversary of its foundation. The chairman of the Society stressed in the opening remarks for the symposium that the family was the most important conifer family of the southern hemisphere, the true relict of Gondwana, which played a crucial role in the evolutionary chain, from the fossil record to today's species.

But when we consider information presented in the pages of the symposium's proceedings (and elsewhere), evolution's 'big picture' of the Araucariaceae struggling to hold on against angiosperms fails to stand up to scrutiny.

The data doesn't support the story

While there are many articles in the proceedings that maintain the chairman's emphasis on the relictual nature of Araucariaceae, particularly the contributions of the paleontologists, there are other articles that present data that clearly undermines the claim that Araucariaceae cannot compete with angiosperms.

For example, in their description of Araucariaceae in New Caledonia, Manaute *et al.*[4] describe the real situation in the field, namely that Araucariaceae are a prominent element in the vegetation of New Caledonia. They also describe how the angiosperm associates of the Araucariaceae vary according to the ecological conditions, in particular soils and altitude. The list of angiosperm associates of the Araucariaceae is extensive and is definitely not restricted to those angiosperms that are normally dismissed as being primitive. Even that list is dwarfed by the list of the associates of Araucariaceae given by Wilcox[5] in his description of the post-conference tour of New Caledonia.

The richness of the angiosperm associates of the Araucariaceae in New Caledonia would probably be glossed over by saying that New Caledonia is an isolated island in which evolution has not caught up with the rest of the world, where Araucariaceae are unable to compete with angiosperms. However, the symposium proceedings also include an article which the author wrote, entitled "Araucariaceae, angiosperms and people".[6] It deals with the Araucariaceae/angiosperm relationship worldwide, reviewing the ecological literature on this topic from all the countries in which the family Araucariaceae exist today. It is not just a literature review, as it includes my own observations of the Araucariaceae on the ground in South America (Chile, Argentina, and Brazil), South-East Asia (Malaysia and Indonesia) and New Caledonia. The article examines the relationship in the context of underlying physical environment (climate, soil, topography) and of the impact of human activities on the vegetation. It spans many

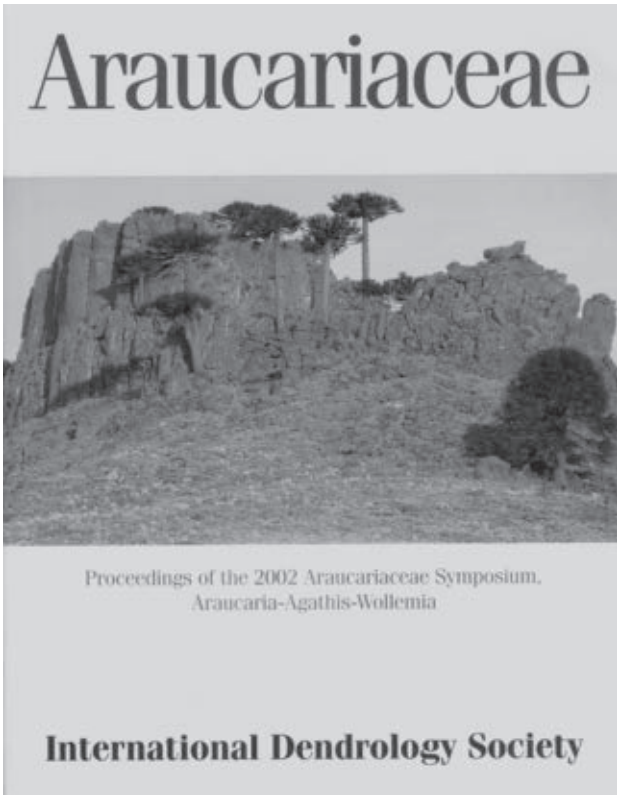

Figure 1. The front cover of the *Proceedings of the 2002 Araucariaceae Symposium*, published in 2009

years of observations, given that I first carried out ecological studies of the Araucariaceae in New Guinea in the 1950s, also at that time closely observing them in Australia, New Zealand, and Fiji (and since). I later published my studies (1965,[7] 1971,[8] 1972[9]). In the 1990s I returned to New Guinea to see first-hand if, how, and where the situation had changed. (And it turned out that where it *had* changed, it was not because of competitive pressure from angiosperms. Rather, it was because the ecology had been powerfully impacted by factors related to human activity, as I shall discuss later.)

Abundant angiosperms—benign companions

Family Araucariaceae associations with angiosperm species are abundant, in all the regions of the world where Araucariaceae are present. For example, the island of New Guinea (to Australia's north) where Araucariaceae can be found growing mainly in the middle altitudes on the mountain ranges, i.e. between the lowland tropical rainforest and the alpine tundra. (They are generally not found in the wet lowlands, the southern dry and fire-prone lowlands, and frost-prone high mountains.) Where Araucariaceae occur, it is in association with a large number of angiosperm species. To save space, instead of enumerating individual species, only the families to which they belong are given. The angiosperm families occurring in association with Araucariaceae in New Guinea include: Datiscaceae, Combretaceae, Mimosaceae, Sterculiaceae, Euphorbiaceae, Flacourtiaceae, Ulmaceae, Meliaceae, Sapotaceae, Moraceae, Lauraceae, Malvaceae, Rutaceae, Magnoliaceae, Burseraceae, Ebenaceae, Elaeocarpaceae, Urticaceae, Rhamnaceae, Boraginaceae, Apocynaceae, Fagaceae, Juglandaceae, Clusiaceae, Himatandraceae, Proteaceae, Myrtaceae, Theaceae, and Casuarinaceae.

For readers who want further detail on this, along with a much more extensive listing of the many angiosperm families associated with Araucariaceae in numerous other regions of the world, please see the online supplementary information to this article.[10]

Why the apparent contraction of the Araucariaceae?

The contraction of a group of plants needs to be defined in terms of time and mode. The most commonly used timescale for the contraction of the Araucariaceae is the long one—in terms of geological time, especially from the time of the dinosaurs to the present. As supposed evidence, evolutionists claim that in the rocks assigned to the Cretaceous era the family Araucariaceae was more widespread, not largely confined to the southern hemisphere as now. There is also a greater proportion of fossils assigned to the Araucariaceae compared to those assigned to angiosperm families, though in Patagonian Cretaceous rocks Menendez in (1972)[11] recorded quite an impressive suite of angiosperm families alongside the fossil Araucariaceae. These included: Monimiaceae, Lauraceae, Menispermaceae, Saxifragaceae, Anacardiaceae, Vitaceae, Myrtaceae, Sterculiaceae, Araliaceae, Bignoniaceae, Poaceae, and Cyperaceae.

The changed proportion of Araucariaceae and angiosperms is then interpreted in evolutionary terms, namely that the primitive Araucariaceae have been, or are being, displaced by the more advanced angiosperms. This is the position taken by Womersley (1958),[12] Robbins (1962),[13] and Aubreville (1965)[14]—the 'big names' in academic study of Araucariaceae when I was first embarking upon my own studies—and more recently by van der Burgh (2009),[15] who considers the family Araucariaceae to be too specialized or too adapted to humid climate. He contrasts them to the family Pinaceae of the northern hemisphere, which by comparison has flourished and occupies extensive areas of that hemisphere. However, this ignores the fact there are very limited bioclimatic regions in the southern hemisphere that Pinaceae could occupy, just as there are limited bioclimatic regions, such as the Malay Peninsula and the adjacent island groups, which Araucariaceae can occupy in the northern hemisphere.

Though van der Burgh identifies the similarities (bract scale complex and inverted seed) and differences (disintegration vs retention of cone on maturity) between Araucariaceae and Pinaceae, he does not recognize the

ecological significance of the differences. Cones that do not disintegrate on maturity and are retained for a number of years (serotinous) can provide long-term protection for the seeds, which can be shed after fire and provide the basis for the subsequent regeneration. This is what happens repeatedly to extensive pine forests in Eurasia and North America. The fact that Araucariaceae lack this capability handicaps them in fire-prone continental climates, particularly when the frequency of fire is increased by human activity. Some have suggested that fire might open the way for colonization by certain angiosperms which then begin to outnumber the Araucariaceae and so begin to outcompete them, i.e. that it is a combination of fire and angiosperms which suppresses the Auracariaceae. However, the author's assessment is that it is *fire*, directly and indirectly promoted by *human activity*, that is the chief cause of the current observable contraction of the Araucariaceae, and that it cannot be ascribed solely by any measure to the putative competition by angiosperms.

There are many pointers to the importance of fire, rather than the presence of angiosperms, as being a major determinant of Araucariaceae distribution. For example, Kershaw and Wagstaff in 2001[16] presented a range of evidence indicating that a principal control on Araucariaceae abundance is frequency of fires. They pointed to widespread decline in Araucariaceae during periods of high fire frequency associated with aboriginal burning, and also with episodes of dry climate and high incidences of lightning strikes igniting fires. During periods of wetter climatic conditions and fewer fires the Araucariaceae become widespread, often coming to dominate a forest. And another commentator, musing on the distribution, diversity, and success of the Araucariaceae in Australasia, wrote:

> "This is a striking pattern because it means that *this family of conifers has been most successful in precisely the environment where angiosperms are generally thought to have most successfully replaced conifers*—in the tropical rainforests [emphasis added]."[17]

Reality of the Araucariaceae/angiosperm balance

Although the displacement of Araucariaceae by angiosperms is often mentioned and even pushed as a religious mantra by many writers, the identity of the angiosperms that have the capacity to cause this displacement appears to be a trade secret. It is only in localized ecological studies like Whitmore (1966),[18] Webb and Tracey (1967),[19] Havel (1971),[8] Enright (1995),[20] Jaffre *et al.* (2001),[21] and Ogden and Stewart (1995)[22] that the coexistence of Araucariaceae and angiosperms is acknowledged and recorded. The families of angiosperms coexisting with Araucariaceae as recorded in my article in the 2009 proceedings,[6] and in the supplementary information to this article,[10] is an impressive list—and there may be many others yet to be identified. Therefore it is a reasonable question to ask: which are the mysterious angiosperms that are pushing Araucariaceae toward extinction?

A 'complex ecological setting' influenced by soils, climate, human activity

There are other studies of present-day coexistence of angiosperms and Araucariaceae. In addition to those mentioned in the preceding paragraph for south-west Pacific Region, there are similar studies from South America of Armesto *et al.* (1995),[23] Armesto *et al.* (1997),[24] Dimitri (1972),[25] Veblen (1982),[26] and Veblen *et al.* (1995),[27] which record the coexistence of the Araucariaceae and angiosperms and analyze the conditions that influence the regeneration patterns. Even in these studies assumptions are inevitable, such as what history is reflected in the diameter distribution within the stands that are being studied.

This leads to the recognition that angiosperm/gymnosperm competition does not occur within a vacuum, but within a complex ecological setting in which physical factors such as climatic changes, and social factors, such as changes in human subsistence (Golte, 2009),[28] also play a part. Golte's study points out three major regions (Chile, southern Brazil and south-east Queensland), in which Araucarias of the subsection Araucaria, which have large edible seeds, once formed the subsistence basis of indigenous societies and influenced the structure of these societies. The subsequent European colonization did not just diminish the bulk of the Araucarias and the angiosperms associated with them, but also dramatically impacted the people dependent on them.

Araucariaceae can tolerate extremes of temperature, soils—bye-bye extinction theory

Nix's (1991) study of climatic determinants of the occurrence of plant species[29] shows that in terms of temperature tolerance Araucariaceae in Australia are predominantly mesotherms. However, *Araucaria araucana* is a microtherm and some species of *Agathis* are macrotherm. So in total, the Araucariaceae have a wide temperature tolerance. Similarly, in terms of rainfall, although Araucariaceae have preference for moderately high, non-seasonal rainfall, they range from the relatively dry climate of southern Queensland, western New Caledonia and western Argentina, to the very wet climate of Chile, Malesia and the mountains of New Caledonia.

In terms of soil extremes, the Araucariaceae range from the soils derived from ultrabasic rocks in New Caledonia and Borneo, to infertile and acid soils derived from sediments in Borneo and New Zealand. Such broad tolerances to extreme environmental conditions are hardly indicative of a relict family on the way to extinction.

The Araucariaceae-angiosperm nexus

The real relationship between Araucariaceae and angiosperms can be summarized by three main points:

a. The claim that angiosperms are responsible for the current discontinuous distribution of the Araucariaceae, which is a reduction of their former broader distribution, is not supported by actual evidence, but is conjecture.
b. The distribution of the Araucariaceae and their numerous angiosperm associates at the beginning of the modern era 200–300 years ago was largely determined by interplay of environmental factors, particularly through their effect on the frequency and intensity of fire.
c. That distribution was already affected by human activity over the previous millennia. The degree of impact varied between the many regions in which Araucariaceae occur. However, the main human impact has occurred over the past 200–300 years, i.e. mainly since European colonization, with its associated land settlement activities and increased intensity of wildfires.[30]

The real reason for the perpetuation of the myth of the inferiority of the Araucariaceae?

Given the lack of observable and measurable evidence for the inferiority of the Araucariaceae, and their displacement by the angiosperms, the obvious question is: What is the motive for continuing to espouse that line? Could the likely primary motive be the strategic defence and promulgation of evolutionary theory? And as typically occurs, the attempts to prop up evolutionary theory are not consistently applied. For example, if angiosperms are outcompeting Araucariaceae because angiosperms are more 'advanced', then why doesn't the same 'argument' hold for the Pinaceae as well? (Pinaceae continue to dominate a large proportion of the northern hemisphere land masses.)

Araucariaceae as 'props' for another evolutionary 'icon'—the dinosaurs

Where do the Araucariaceae get their main exposure? Probably most people do not recognize them as objects of a merit of their own, but as strange looking props in the so-called scientific documentaries about dinosaurs—the ultimate evolutionary 'icon'. Given the strong and unusual structure of Araucariaceae tree crowns, they make the ideal props for dinosaur tales (figure 2). Seeing that dinosaur fossils occur in the same deposits as the Araucariaceae, and seeing that all dinosaurs are extinct, then evolutionary theory dictates that Araucariaceae must be living fossils heading for extinction. This would account for the emphasis on *Wollemia*, the genus with its only species (the already-mentioned so-called 'dinosaur tree', *W. nobilis*) occurring in one gorge. It is hardly consistent with the numerous species

Image: MPF / CC BY 2.5

Figure 2. The striking crown shapes of *Araucaria araucana*

of the genera *Araucaria* and *Agathis*, spread over ranges of hundreds of kilometers.

Observational science versus storytelling

Science focusing on the occurrence and distribution of the Araucariaceae should be based on objective experimental studies or at least on detailed ecological surveys. Experiments require sufficient replications to support statistical analysis and test hypotheses. That at least was the way that I did my studies on *Araucaria hunsteinii* autecology and synecology 50 years ago.

True, even 100 years or more ago there were popularizers of science like H.G. Wells and Jules Verne, who spun fantastic yarns, but most readers knew the difference between those yarns and the real science, like that done at that time by Louis Pasteur in the field of microbiology. Now, in large measure likely because of the influence of propaganda organizations such as the BBC, many people today evidently do not know the difference between storytelling and truth.

Recognizing propaganda

I am conscious that describing the BBC as a 'propaganda organization' may date me as being 'old and grumpy', but over the past eight decades I have come across a lot of propaganda and I recognize it when I see it. I experienced both the Nazi theory on the superiority of the Germanic race and the communist theory on the just dictatorship of the proletariat. I learned that each propaganda effort needs to have a picture capable of grabbing attention. Nowadays we call them icons. I have some of these pictures strongly imprinted in my mind.

Figure 3. Adolf Hitler was neither tall nor blonde, but that did not stop him appealing to those who were. But what were the foundations of Hitler's ethics that were so attractive to so many?

Propagandist Hitler

In 1942, my high school in Kralupy, in what is now the Czech Republic, was kicked out of the ground storey of its building to accommodate a group of German refugee children from Romania. Their classrooms were decorated with large, coloured images of tall, blonde, blue-eyed youths doing heroic things. There was a slight mismatch, in that the children using the classrooms were generally neither tall nor blonde. They were no heroes, just refugees. The prophet of that theory, Hitler (figure 3) was not tall, blonde, or heroic, but that did not stop him from being a very effective propagandist who fooled a lot of people for over a decade.

From Czech to 'mate'

In 1948, I ran into another effective propaganda machine. In this case, the icons were muscular men with hammers and scythes, wearing clothes with red stars. The cause they were promulgating was the dictatorship of the proletariat. The people in the iconic pictures and statues were probably actors. They did not look much like my grandfather, who was a miner, as were his forefathers for the four generations that I can trace, and probably beyond that. The minister pushing the propaganda and controlling the education, Nejedly, was no proletarian worker, but a middle-class communist intellectual. However, he was an effective propagandist who became a powerful man, whilst I became a stateless refugee until Australia gave me a new home.[31]

Exposing the evolutionary propaganda effort—and thwarting it

It is because of these experiences that I view the dinosaur/*Araucaria* icons, and the insistence that Araucariaceae are being pushed toward extinction by angiosperms, as a propaganda effort for evolution. After all, it is a more spectacular icon than mono-cellular eubacteria emerging from warm muddy water, which is the basic postulate of evolution. The link with Pasteur's experiments again comes to mind, as he proved conclusively that no life emerges from sterilized water. Obviously, such facts are not allowed to interfere with the propaganda effort.

In that light, scientists should re-evaluate the purported relict stand of Araucarias in western Argentina on the front cover of the book. As an icon it is superb—few surviving trees in a stony desert might superficially suggest an approaching end point. However, if the front cover picture were to be quantified in terms of vegetative cover, my rough assessment would be something like: Araucariaceae 10%, angiosperm herbs 2%, angiosperm trees 0%, with the remainder being bare rock. This is hardly a demonstration of the common claim that the Araucariaceae are relict because of having been displaced by the evolutionarily superior angiosperm trees. An article within the Proceedings by Sanguinetti *et al.* (2009)[32] from the same region of Argentina attributes the current paucity of *Araucaria* regeneration to human activity, principally intensive grazing and frequent intentional fires, which has been going on for the past 150 years. Dimitri (1972)[25] commented that because of its thick bark, *Araucaria* copes better with fire than, say, ecologically comparable angiosperms such as *Nothofagus* spp. In the cover picture of the *Proceedings*, the only angiosperm to survive the human pressure is the grass *Stipa speciosa*. The fact that only the Araucariaceae and no angiosperm trees have survived, and that any decline was likely due to abusive land use, is not allowed to spoil the story.

Unfortunately, this picture of the relict Araucariaceae stand may be prophetic. Most articles have focused on what might have happened to the Araucariaceae 'since the Cretaceous era', instead of within the last 200–300 years. Accordingly, much has been postulated about the impact of the angiosperms and not enough attention focused on addressing the human-induced extermination of the Araucariaceae that is still underway. As such, the situation may be symptomatic of a more widespread problem in present-day science—whereby ideological bias stimulates a lot of misdirected effort, resulting in propaganda rather than problem-solving.

Conclusion

The claims made by proponents of evolutionary theory regarding its ability to explain the world in which we live should be recognized as the propaganda that it clearly is. For when one considers the 'hard data' of the real world, evolutionary ideas fail under scrutiny. The Araucariaceae provide a clear demonstration of that, as unbiased data points to the Araucariaceae's ability to thrive alongside

angiosperms, rather than being out-competed by them. The ability to tolerate a range of soil and temperature extremes is hardly the characteristic of 'relict' vegetation, but of plants eminently fit for survival. Attempts to render the Araucariaceae as an 'icon' of evolution will certainly fail in the eyes of those who are alert to propagandists' spin and to the fact that the evolutionary storyline just does not fit with real-world observation. Rather, the evidence of the Araucariaceae today is that this family of plants were among all the vegetation created by God to grow out of the earth on Day 3 of Creation Week, subsequently reproducing according to their various kinds. Growing and reproducing is something that the Araucariaceae and other plants evidently continue to do to this day, and do very well indeed.

References

1. Sensational Australian tree … like 'finding a live dinosaur', *Creation* **17**(2):13, 1995, creation.com/woll.
2. Catchpoole, D., 'Dino tree' project ends: after all the hoopla, the Wollemi project winds up with a whimper, creation.com/dino-tree-project-ends, 2 July 2009.
3. Bieleski, R.L. and Wilcox, M.D. (Eds.), *Araucariaceae: Proceedings of the 2002 Araucariaceae Symposium, Araucaria-Agathis-Wollemia*, International Dendrology Society, Auckland, New Zealand, 14–17 March 2002—International Dendrology Society, Dunedin, 2009.
4. Manaute, J., Jaffre, T., and Kranitz, M., Review of the Araucariaceae in New Caledonia; in: Bieleski and Wilcox, ref. 3, pp. 347–358.
5. Wilcox M. International Dendrology Society Araucariaceae tour to New Caledonia, March 2002; in: Bieleski and Wilcox, ref. 3, pp. 525–538.
6. Havel, J.J., Araucariaceae, angiosperms and people; in: Bieleski and Wilcox, ref. 3, pp. 107–132.
7. Havel, J.J., Plantation establishment of klinki pine (*Araucaria hunsteinii*) in New Guinea, *Empire Forestry Review* **44**:172–187, 1965.
8. Havel, J.J., The *Araucaria* forests of New Guinea and their regenerative capacity, *J. Ecology* **59**:203–214, 1971.
9. Havel, J.J., New Guinea forests—structure, composition and management, *Aust. For.* **36**:24–37, 1972.
10. Viewable at creation.com/supplementary-info-araucariaceae-havel.
11. Menendez, C.A., Palaeofloras de la Patagonia; in: Dimitri, M.J. (Ed.), *La Region de los Bosques Andino-Patagonicos*, Sinopsis General INTA, Buenos Aires, pp. 129–184, 1972.
12. Womersley, J.S., The *Araucaria* forests of New Guinea; in: *Proc. Symp. Humid Tropics Vegetation*, UNESCO, Tjiawi, Indonesia, pp 252–257, 1958.
13. Robbins, R.G., The podocarp-broadleaf forests of New Zealand, *Transactions of the Royal Society of New Zealand (Botany)* **1**:33–75, 1962.
14. Aubreville, A., Les forets tropicales denses Australiennes et leurs coniferes, *Revue Bois et Forets des Tropiques* **104**:3–16, 1965.
15. van der Burgh, J., Araucariaceae: development and decline; in: Bieleski and Wilcox, ref. 3, pp. 15–20.
16. Kershaw, A.P. and Wagstaff, B., The southern conifer family Araucariaceae: history, status, and value for paleoenvironmental reconstruction, *Annu. Rev. Ecol. Syst.* **32**:397–414, 2001.
17. Earle, C.J. (Ed.), The Gymnosperm Database: Araucariaceae, conifers.org/ar/Araucariaceae.php, accessed 21 December 2017.
18. Whitmore, T.C., The social status of *Agathis* in a rain forest in Melanesia, *J. Ecology* **54**:285–301, 1966.
19. Webb L.J. and Tracey J.G., An ecological guide to new planting areas and site potential for hoop pine, *Australian Forestry* **31**:224–239, 1967.
20. Enright, N.J., Conifers of tropical Australasia; in: Enright, N.J. and Hill, R.S. (Eds.), *Ecology of the Southern Conifers*, Melbourne University Press, Melbourne, Australia, pp. 197–222, 1995.
21. Jaffre, T., Morat, P., Veillon, J.M, Rigalt, F., and Dagostini, G., *Composition et caracterisation de la flore indigene de Nouvelle Caledonie, Documents Scientific et Technique II 4*, IRD Noumea, 2001.
22. Ogden, J. and Stewart, G.H., Community dynamics of the New Zealand conifers; in: Enright and Hill, ref. 20, pp. 81–119.
23. Armesto, J.J., Villagran, C., Aravena, J.C., Perez, C., Smith-Ramırez, C., Corm M., and Hedin L., Conifer forests of the Chilean coastal range; in: Enright and Hill, ref. 20, pp. 156–170.
24. Armesto, J.J., Villagran, C., and Arroyo, M.K., *Ecología de los bosques nativos de Chile*, Ed. Universitaria, Santiago de Chile, 1997.
25. Dimitri, M.J., *La Región de los Bosques Andino-Patagónicos: Sinopsis General, Tomo. X.*, Colección Científica del INTA, Buenos Aires, 1972.
26. Veblen, T.T., Regeneration patterns in *Araucaria araucana* forests in Chile, *J. Biogeography* **9**:11–28, 1982.
27. Veblen T.T., Burns, B.R., Kitzberger T., Lara, A., and Villalba, R., The ecology of conifers of southern South America; in: Enright and Hill, ref. 20, pp. 120–155, 1995.
28. Golte, W., *Araucaria* seeds as a staple food: a cultural-ecological convergence of three harvesting peoples in South America and Australia; in: Bieleski and Wilcox, ref. 3, pp. 482–490.
29. Nix, H.A., An environmental analysis of Australian rainforests, in: Warren, G. and Kershaw, P. (Eds.), *The Rainforest Legacy: Australian National Rainforest Study, Volume 2*, Australian Government Publishing Service, Canberra, pp. 1–27, 1991.
30. Editorial Board, Bushfires in Australia, *Australian Science*, australianscience.com.au/news/bushfire-in-australia/, 29 October 2013.
31. For more see: Seeing a way through the forest: Gary Bates and Don Batten talk to forest and ecology authority Dr Jaroslav Joseph (Joe) Havel, *Creation* **28**(2):52–55, 2006; creation.com/havel-interview.
32. Sanguinetti, J., Maresca, M., Gonzales Penalba, M., and Chauchard, L., Estimation of gross production of pinons in the *Araucaria araucana* forests of the Lanin National Park— Argentina; in: Bieleski and Wilcox, ref. 3, pp. 503–510.

Jaroslav Joseph Havel *received a B.Sc. in Forestry from the University of Western Australia, a M.Sc. in Forestry from the University of Queensland, and a Ph.D. from Murdoch University. He also received a Diploma in Forestry from the Australian Forestry School in Canberra, a Diploma in Education from the University of Western Australia, and a Diploma in Theology from Moore Theological College. In Papua New Guinea he researched the plantation establishment of Araucarias, and worked in regional management. He was the founding principal of Forest College, and also compiled a forest botany textbook. In Western Australia, he conducted computer-based classification and mapping of forest vegetation. He also supervised research and carried out land use planning and retired as Director of Research and Planning in the Department of Conservation and Land Management. Post retirement, he has been a consultant to the Western Australian State Government on catchment planning and vegetation mapping, and has conducted impact assessment for private firms and foreign aid on reforestation in Indonesia for the Australian Federal Government. He has studied Araucarian ecology in Australia, Papua New Guinea, Indonesia, Malaysia, Fiji, New Caledonia, New Zealand, Brazil, Argentina, and Chile.*

Does Ezekiel 28:11–19 affirm the fall of Satan in Genesis 1:1–2 as claimed in the gap theory?

Joel Tay and KeeFui Kon

The gap theory claims that Ezekiel 28:11–19 and Isaiah 14:12–15 refer to the fall of Satan in the mineral Garden of Eden before Creation Week. This event is said to have occurred in between Genesis 1:1 and 1:2. Gap proponents are intimidated by secular geologists who claim that the earth is billions of years old. By inserting billions of years between Genesis 1:1 and 1:2, gap proponents assume that this allows them to reconcile Scripture with the idea of long ages. This paper demonstrates that the passage in Ezekiel 28 cannot relate to this supposed time gap even if the passage refers to the fall of Satan. If the text is understood as a reference to the fall of Satan, we would still be required to interpret the timing of Satan's fall as an event that occurred after the sixth day of creation, and the final judgment of Satan is reserved for fire rather than water. We show that the gap theory is an extrabiblical and artificial construct that has been imposed upon the text of Genesis 1:1–2, and that Ezekiel 28 is actually problematic for the gap theory.

Gap theory claims that there was a previous earth that was created and then destroyed billions of years ago because of the rebellion of Lucifer. This supposedly took place prior to the Creation Week mentioned in Genesis 1. It is postulated that when Lucifer fell into sin, God destroyed this earth with a worldwide (Lucifer's) flood and then recreated the world. This is also called the ruin–reconstruction or creation–recreation theory. This event is said to have occurred in a time gap between Genesis 1:1–2. The gap theory was proposed to reconcile Scripture with the emerging notion that the earth is billions of years old in the developing uniformitarian geology of the 18th and 19th centuries.

German Protestant theologians Johann Georg Rosenmüller (1736–1815) and Johann August Dathe (1731–1791) were the first to propose the early ideas for the gap theory. Later, Thomas Chalmers (1780–1847), who founded the Free Church of Scotland, actively promoted it.[1] From 1909, Cyrus Ingerson Scofield popularized the gap theory through his widely distributed *Scofield Reference Bible*.[2]

The teaching of the gap theory is built on the following ideas:

1. a long time ago, God created the heavens and the earth (Genesis 1:1)
2. Lucifer and the angels ruled the earth filled with soulless humans
3. Lucifer resided in the mineral Garden of Eden (Ezekiel 28:11–19), desired to be like God, and eventually rebelled against God (Isaiah 14:12–15)
4. as a result of Satan's rebellion, sin entered into the world
5. God destroyed the earth and everything in it with a worldwide Flood that produced the fossils and rock layers we see today
6. after the destruction of the earth, God recreated the earth (Genesis 1:2)
7. the recreation of the earth and life took six 24-hour days (Genesis 1:3–31).

The gap theory presupposes the fall of Lucifer, the *Day Star*, who is also known as Satan after his fall, to have occurred between Genesis 1:1 and 1:2. In this article, we endeavour to examine the interpretation of Ezekiel 28:11–19 and its application to Genesis 1:1–2, focusing on the timing of Satan's fall and his judgment.

Interpretation of Ezekiel 28:11–19

Ezekiel 28:11–19 is notorious for being a difficult passage to interpret, resulting in differing views among evangelicals.

In the first interpretation, some commentators suggest that this passage is simply a reference to the human king of Tyre.[3] In this view, this whole passage should be interpreted as mocking the foolish thinking of the king. One of the objections that can be raised against this interpretation is the reference to a guardian cherub who walked about in Eden, the Garden of God. Even if the passage speaks about the human king of Tyre, human beings are never called 'cherubim', which are angelic beings with wings (Ezekiel 10:1–5). Calling a human a 'cherub' requires an allegorical interpretation of the passage. Some authors go as far as to allegorize that the Garden of Eden is simply a reference to a

garden in the king's palace or temple in Ezekiel's day. They surmise that the reference to perfection is just a poetic way of saying that the king was full of splendour.

The second interpretation comes from other ancient commentaries such as the Jewish *Talmud* and *Targumim*. In these commentaries, this passage alludes to the fall of the king, linking it metaphorically to the fall of Adam in the Garden of Eden. The King of Tyre was not regarded as literally being in the Garden of Eden but he was provided with the luxuries that equal those of paradise in Eden. But is this passage analogous to the fall of Adam? Just as it is with the first interpretation, this explanation fails to account for the difference between cherub and man. In contrast to the cherub of Ezekiel 28, Adam was not adorned with precious stones and gold from his head to his feet on the day he was created. Adam was made naked and he was not ashamed of this until he fell into sin. And while Adam was instructed to cultivate the Garden of Eden, it would be difficult to see how he could be called an anointed guardian cherub, much less walk in the midst of stones of fire. Cherubim are angels tasked with guarding the Garden of Eden (Genesis 3:24); standing by the wheels of the throne of God (Ezekiel 10); and overshadowing the mercy seat of the Ark of the Covenant (Hebrews 9:5). In Ezekiel 28:11–19, the cherub is judged by a fire with no chance of reconciliation. In contrast, when Adam sinned in Genesis 3:6–7, God reconciled him and clothed him with animal skin (Genesis 3:15, 21)—a picture of the final reconciliation and redemption through the Cross.

The third interpretation, held by Tertullian and Origen, is that Ezekiel 28:11–19 speaks about the fall of the King of Tyre and then likens his fall to the fall of Satan and Satan's power at work in the human king.[4] Later, Scofield endorsed this interpretation.[5] In this view, Satan, in his unfallen state, was placed in Eden, the Garden of God. He is called the anointed guardian cherub who is perfect, beautiful, completely adorned with precious stones and gold, and who walked in the midst of the stones of fire. This cherub fell because of pride and will face judgment by fire. This third interpretation is also the view of most gap proponents.

While we have reviewed these views but have not taken a particular view, we shall now assume the third interpretation of gap proponents and examine whether or not it can indeed be applied to support the gap theory.

Timing of the fall of Satan

If Ezekiel 28:11–19 speaks about the fall of Satan, it should give us important clues when Satan fell.

Ezekiel 28:13–17:

> "You were in Eden, the garden of God; every precious stone was your covering... On the day that you were created they were prepared … You were an anointed guardian cherub. I placed you; you were on the holy mountain of God; in the midst of the stones of fire you walked. You were blameless in your ways from the day you were created, till unrighteousness was found in you ... so I cast you as a profane thing from the mountain of God, and I destroyed you, O guardian cherub, from the midst of the stones of fire. Your heart was proud because of your beauty; you corrupted your wisdom for the sake of your splendor. I cast you to the ground ... ."

In the initial verses 13–15, Satan was still in his perfect state in the Garden of Eden. In fact, Job 38:4–7 reveals that the angelic beings were rejoicing when God was laying the foundation of the earth before the creation of the Garden of Eden. In his former state, Satan was celebrating with God's initial act of creating the earth, as recorded in Genesis 1:2. Genesis 2:7–9 indicates that God planted the Garden of Eden only after Adam was created on the sixth day of Creation Week and both creation and the Garden of Eden were still very good at the end of the sixth day (Genesis 1:31). So a plain reading of Ezekiel 28:13–19 requires Satan's fall to occur, at the earliest after the sixth day of creation. Yet if Satan had not yet fallen into sin on the sixth day of creation, how then could there have been a judgment on Satan between Genesis 1:1 and 1:2? The timing of the fall of Satan in Ezekiel 28 could not have occurred between Genesis 1:1 and 1:2 as the gap theory proposes.

Figure 1. Did Satan fall before Creation Week?

In order to fit Satan's fall in between Genesis 1:1 and 1:2, gap proponents introduced another Garden of Eden, a mineral garden that was made for Lucifer.[6] After the rebellion, this garden was destroyed with the rest of the earth and then recreated with a second Garden of Eden.[7] However, this proposal of a mineral garden requires reading between the lines of Genesis 1:1 and 1:2 and is based on an argument from silence with no exegetical basis.

Watery judgment on Satan

To support the gap theory, gap proponents also presuppose a water judgment called 'Lucifer's flood' before Genesis 1:2 to conform to the fossils and geologic record of billions of years. But such a reading into the text does not hold water (pardon the pun). Although Genesis 1:2 mentions water, elevating it to Lucifer's flood is counterintuitive because the judgment was ineffective against Satan while other creatures were destroyed. Satan escaped, appeared in the purported second Garden of Eden billions of years later, tempted Adam and Eve, and then was cursed. After failing to destroy Satan with water, God could only curse him as he continued to cause mischief to mankind (Genesis 3:14). This view contradicts the all-powerful God and the sure judgment on Satan in Ezekiel 28:18–19. Moreover, the judgment mentioned in verse 18 is one of fire rather than water.

Gap proponents sometimes claim that 2 Peter 3:4–7 speaks about the flood that occurred when Satan fell into sin before the six days of creation. The passage reads:

> "They will say, 'Where is the promise of his coming? For ever since the fathers fell asleep, all things are continuing as they were from the beginning of creation.' For they deliberately overlook this fact, that the heavens existed long ago, and the earth was formed out of water and through water by the word of God, and that by means of these the world that then existed was deluged with water and perished. But by the same word the heavens and earth that now exist are stored up for fire, being kept until the day of judgment and destruction of the ungodly."

But "all things are continuing as they were from the beginning of creation" in verse 4 refers to history from the Creation Week. It follows that verse 5–6 would point to Noah's Flood after the Creation Week. Furthermore, Noah's Flood is explicit in Genesis 6–8. It makes no sense for Peter to write about a muted Lucifer's flood and thus leave out the global flood judgment in Noah's day. In fact, Peter sets the context that the flood came during the days of Noah in the earlier chapter, in 2 Peter 2:4–5, which reads:

> "For if God did not spare angels when they sinned, but cast them into hell and committed them to chains of gloomy darkness to be kept until the judgment; if he did not spare the ancient world, but preserved Noah, a herald of righteousness, with seven others, when he brought a flood upon the world of the ungodly … ."

When 2 Peter 3:4–7 is read in light of 2 Peter 2:2–4, it becomes clear that the 'world that was deluged by water and perished' is not Lucifer's flood at pre-Creation Week but Noah's Flood at post-Creation Week.

While the earth was judged, there is no explanation in the gap theory for why the heavens would also have been judged along with the earth. Yet if the heavens were not judged, then the recreation of the heavens, including the sun, moon, and stars in Genesis 1:14–19, was unnecessary. The judgment of only the earth does not fit the gap theory.

Implications of the gap theory

The proponents of the gap theory try to harmonize Scripture with geology by inserting a long time gap between Genesis 1:1 and 1:2. For this theory to work, gap proponents must not only invent an imaginary fall of Satan before the Creation Week; they must also invent an imaginary mineral Garden of Eden and an imaginary Lucifer's flood, and then place this entire edifice before Genesis 1:2. But such an approach would be contrary to sound exegesis. Gap proponents cite Ezekiel 28:13–19 for scriptural support. But as we have shown, Ezekiel 28 tells us that Satan could not have rebelled against God before the sixth day of creation. This undermines the very purpose of the gap theory, which is to attempt to stay faithful to Scripture while accounting for the billions of years of uniformitarian geology.

Furthermore, since gap proponents claim that the fossils and rock layers are billions of years old, they must commit to the idea that Lucifer's flood produced the fossils and rock layers we see today. In other words, they must reject the Flood of Noah since such a global flood would certainly have destroyed traces of a prior Lucifer's flood and it would have laid down its very own set of rocks and fossils. But if Noah's Flood was responsible for the fossils and rock layers, there is no longer any basis for the supposed 'billions of years', and no purpose for a gap theory. At best, gap proponents can only accept a local flood in Mesopotamia.[8]

The attempt to satisfy the secular worldview of billions of years of the earth ends in a compromised account of biblical creation. The plain narrative of Genesis 1:1–2 simply tells us that the earth was unformed and unfilled at the initial stage of its creation and was only otherwise at the end of the sixth day of creation.[9] The application of this interpretation of Ezekiel 28:11–19 to the fall of Satan before Genesis 1:2 is problematic for the gap theory. When God laid the foundations of the earth, the angels were busy singing together and shouting for joy (Job 38:4–7) rather than being judged for rebelling against God. The end result is a view that is neither biblical nor compatible with secular geology.

Other reasons why the gap theory is not compatible with Scripture[10]

1. A plain reading of the Genesis text tells us that God created in six days of 24 hours each. The chronogenealogy listed in the Bible from Adam to Jesus, to this present day, requires a history of the earth and universe in some 6,000 years. This interpretation is supported by Exodus 20:11, "For in six days the Lord made the heavens and the earth … ."
2. Inserting billions of years of death and disease in a ruined earth in between Genesis 1:1 and 1:2 contradicts Genesis 1:31, "God saw all that He had made, and behold, it was very good …."
3. Placing death, disease, and suffering in the first two verses of Genesis 1 before the Fall of Adam also undermines the foundation of the Gospel. Jesus, the last Adam, died a physical death to redeem man from the physical death that came in through the first man, Adam (1 Corinthians 15:45).
4. Jesus taught that Adam and Eve were created from the beginning of creation (Mark 10:6). Inserting billions of years before Adam and Eve puts the first couple at the end of the billions of years instead of the beginning of creation. Suggesting Jesus was wrong commits the kenotic heresy.[11]
5. The belief that billions of years before Adam generated its own fossils and geology requires rejecting the global Flood of Noah and twisting Scripture (1 Peter 3:20, 2 Peter 2:4–5, and 2 Peter 3:4–7) to fit Lucifer's flood.
6. The gap theory contradicts the Hebrew syntax in Genesis 1:1–3. Genesis 1:2 begins with a *waw* followed by a non-verb. This requires the verse to be translated as a *waw* disjunctive ('now') rather than a *waw* consecutive ('and'). In other words, it is not possible to interpret Genesis 1:2 as an event that occurs after verse 1. Rather, the syntax requires us to understand Genesis 1:2 as an in-depth description of what Genesis 1:1 means when it says, 'In the beginning'. The *waw* disjunctive in 1:2 functions like a bracket—a series of three circumstantial clauses that explains Genesis 1:1. Since Genesis 1:2 begins with a *waw* disjunctive, it is not possible to insert a time gap between verses 1 and 2. The gap theory is incompatible with the Hebrew syntax.
7. Last, but not least, Genesis 1:2 is a description of the initial stage of the earth at creation. Reading into Genesis 1:2 a watery judgment using other later scriptures on judgment (Isaiah 34:11 and Jeremiah 4:23) contradicts the principle of God's progressive revelation in biblical interpretation. "Later texts presuppose the prior revelation of earlier texts, not vice-versa."[12] In fact, Isaiah 34:11 and Jeremiah 4:23 were predicting a future and not past judgment.

References

1. Fields, W., *Unformed and Unfilled: A critique of the Gap Theory*, Master Books, Green Forest, AR, p. 36, 2005. Fields was skeptical about the claim by Chalmers that the gap theory was first proposed by Episcopius in the 17th century.
2. Scofield, C.I. (Ed.) 1917 (1909), *Scofield Reference Bible*, Oxford University Press, New York, (See also the *New Scofield Reference Bible*, 1967); studylight.org/commentaries/srn/genesis-1.html.
3. Allen, L., Ezekiel 20–48, *Word Biblical Commentary*, Zondervan, Kindle edn, vol. 29, p. 95, May 2018.
4. Tertullian, *The five books against Marcion*, book II, chap. 10; Origen, *De Principiis*, Book I, chapter 5.4–5.5.
5. Scofield, ref. 2; studylight.org/commentaries/srn/ezekiel-28.html; studylight.org/commentaries/srn/isaiah-14.html.
6. Fruchtenbaum, A., *The Footsteps of the Messiah*, Ariel Press, San Antonio, TX, pp. 548, 549, 555, 2005.
7. Fields, ref. 1, p. 7.
8. However, Fruchtenbaum's version of the gap theory is not for what he calls 'dinosaur space', because he affirms that death was the result of Adam's sin, and affirms that Noah's Flood was global. Fruchtenbaum, A.G., *The Book of Genesis*, Ariel's Bible Commentary, Ariel Ministries, San Antonio, TX, pp. 36–42, 165, 172, 2009.
9. Fields, ref. 1, p. 36.
10. Those interested in reading up more on this should refer to many of the articles already published on creation.com, or to Weston Field's *Unfilled and Unformed* (which is regarded by many to be the definitive critique on the gap theory).
11. Wieland, C., Jesus on the age of the earth, *Creation* **34**(2):51–54, 2012, creation.com/jesus-age-earth.
12. Sarfati, J., *The Genesis Account*, Creation Book Publishers, Powder Springs, GA, p. 114, 2015.

Joel Tay *has a Diploma in Biotechnology from Ngee Ann Polytechnic, a B.Sc. in both Evolutionary Biology and Genetics from the University of Queensland, a Master of Divinity (Theology) from Trinity Theological College, and a Master of Theology (Systematic Theology) from Southwestern Baptist Theological Seminary. He is currently a speaker for Creation Ministries International, US.*

KeeFui Kon *graduated from Massey University with a B.Agr.Sc. and a M.Agr.Sc., majoring in plant nutrition and agronomy. In his Ph.D., he studied population genetics, weed ecology and control at the University of Western Australia. He also completed the one-year Bronze and four-year Silver Medallions in biblical studies at Koinonia Institute, Coeur d'Alene, Idaho. Currently, he is pursuing the Gold Medallion while volunteering as a speaker for Creation Ministries International, Singapore.*

Ancient cosmology and the timescale of Genesis 1

Shaun Doyle

Long-age interpreters often argue that the supposed 'ancient cosmology' of Genesis 1 implies that its seven-day timespan is incidental to the main point of the passage. This overreads the cosmological statements of Genesis 1, but it also does not follow; just because one 'challenging' element of a narrative passage may be incidental does not imply that all its 'challenging' elements are. Nor is there enough evidence to show that Genesis 1 derives its seven-day schema from any previously existing biblical or Ancient Near Eastern pattern. The Ancient Near Eastern context does not justify a rejection of the traditional 'historical week' reading of Genesis 1.

Long-agers often respond to the traditional 'historical week' reading of Genesis 1:1–2:3 with a discussion of 'ancient cosmology'.[1] The Ancient Near East (ANE) apparently had a common 'flat earth, solid sky' cosmology (figure 1). This is also said to be embedded in Genesis 1:

> "Rather, they believed the earth was flat, with heavens above and waters under the earth. Often they referred to the sky as a solid dome, with an ocean of water above it; the dome could open its floodgates, resulting in rain.
>
> "This picture helps us see Genesis 1 more clearly. On day 2 (Gen 1: 6– 8), we read of God creating a 'vault' (NIV) or 'firmament' (KJV) to separate the waters above from the waters below. This is the same structure found in Egyptian and Babylonian thought."[2]

According to this thinking, this shows that God 'accommodated' to the ancient audience by letting the writers tell the story in terms understandable to them. Thus, the 'ancient cosmology' is incidental to the author's real point. Therefore, the reasoning goes, we shouldn't read Genesis 1 as an accurate cosmogony, including its timescale of six 24-hour days (plus one day of rest afterwards). As Haarsma explains:

> "Did you notice the line of reasoning here? We started by considering Genesis 1 within its ancient context, not considering science at all. Yet we learned something relevant for our modern debates: Genesis 1 deliberately uses concepts the first readers would understand rather than the modern scientific picture. This shows that the intent of Genesis 1 was not to address the 'how' and 'when' questions we ask in modern science; these were not a major concern in a pre-scientific era."[3]

Creationists have rightly pointed out that this assumes such falsified scientific ideas are clearly asserted in the Bible.[4] However, there is another problem with this reasoning. Even if, for argument's sake, we were to grant that Genesis 1 testifies to this 'ancient cosmology', it wouldn't preclude the cosmos's being created in six sequential 24-hour days. Why? The '6 + 1 day' pattern of work and rest in Genesis 1:1–2:3 is *not* a part of this supposed ancient cosmological picture. It's an element of the narrative distinct from the setting. Thus, even if we grant the presence of this 'ancient cosmology' in Genesis 1, calling the timescale of Genesis 1 'incidental' because we're supposed to treat the ancient cosmology as incidental does not follow. Just because one 'challenging' element of the narrative is incidental to its main point doesn't mean other 'challenging' elements of the same narrative are. Weeks concurs:

> "Sometimes it seems that those who claim that the Bible used the symbols of its day are merely trying to say that it used a naive as opposed to a scientific cosmology … . If we assume for the sake of the argument that this is the case, then it should be clearly recognized that all we have established is that scientific dogma should not be made out of Biblical cosmology. The argument has no relevance to other parts of the account like the creation of animals, man, etc. Unfortunately this argument is generally used without this careful delimitation. Generally it is argued that the fact that one element shows the use of nonscientific concepts proves that the whole uses naive ideas whose details may not be pressed."[5]

Poetry, cosmology, and chronology

Interestingly, there are scriptural instances of narratival poetry where the setting is suffused with cosmic imagery, but the timescale and sequencing are literal and even historical. For instance, Judges 5, a poetic recounting of Deborah and Barak's victory over Jabin and Sisera, specifies when these events occurred: "In the days of Shamgar son of Anath, in the days of Jael, … ."

It also sets out a basic sequence of events that corresponds with the narrative depiction of the same events in Judges 4. Deborah and Barak arose (v. 12), Israel came out for war in response (vv. 13–18; only some responded), they routed Sisera in war (vv. 19–21), then Jael killed Sisera (vv. 24–27).

Still, there are also fictive and symbolic elements in Judges 5 with no parallel in Judges 4. For instance, the Lord arising from Seir (i.e. from the direction of Sinai) with the creation itself responding with earthquakes and rain (vv. 4–6); the heavens fighting against Sisera (v. 20); and the mocking of Sisera's mother (vv. 28–30). Note also how some of this is *cosmic* imagery: stars fighting (v. 20) and earth and sky trembling at God's mighty presence (vv. 4–6).

The cosmic imagery in Judges 5 is essentially 'special effects', not cosmology. But that doesn't imply the timeframe and sequencing of Judges 5 is similarly non-literal or ahistorical. This is true despite Judges 5 being a song, not narrative prose (as Genesis 1 is[6]), and despite the timeframe not being emphasized (as it is in Genesis 1). As such, cosmic imagery in a passage doesn't guarantee that the timespan spoken of in the same passage is similarly non-literal or ahistorical.

Is the timescale of Genesis 1 incidental?

So, are the numbered days of Genesis 1 incidental to its main point? One indicative means of emphasis in Hebrew narrative is repetition.[7] There are several key phrases repeated in Genesis 1: "and God said", "and it was so", "God saw that it was good", and "there was evening and morning the nth day". The author clearly wants us to understand that these points are crucial to the story he's telling. But notice that *the numbered days, as ordinary 24-hour days*, are one feature of Genesis 1 emphasized through repetition. This would be true even if the narrative was not historical (e.g. a parable). Therefore, the numbered 'days' of Genesis 1 are not incidental; they are an important part of the author's point.

So, what significance might the numbered days of Genesis 1 have? Other repeated elements in Genesis 1 emphasize the goodness of God's creation, or God's sovereign power over His handiwork. For the numbered days, Exodus 20:8–11 suggests the answer:

> "Remember the Sabbath day, to keep it holy. Six days you shall labor, and do all your work, but the seventh day is a Sabbath to the Lord your God. … For in six days the Lord made heaven and earth, the sea, and all that is in them, and rested on the seventh day. Therefore the Lord blessed the Sabbath day and made it holy."

In Genesis 1, Moses likely emphasized God's creative activities as a *work week* to remind the original (ancient Israelite) readership that it was the paradigm from which Israel derived her own work week. This was important because the Sabbath was the primary sign of the Sinai covenant: "You are to speak to the people of Israel and say, 'Above all you shall keep my Sabbaths, for this is a sign between me and you throughout your generations, that you may know that I, the Lord, sanctify you'" (Exodus 31:13).

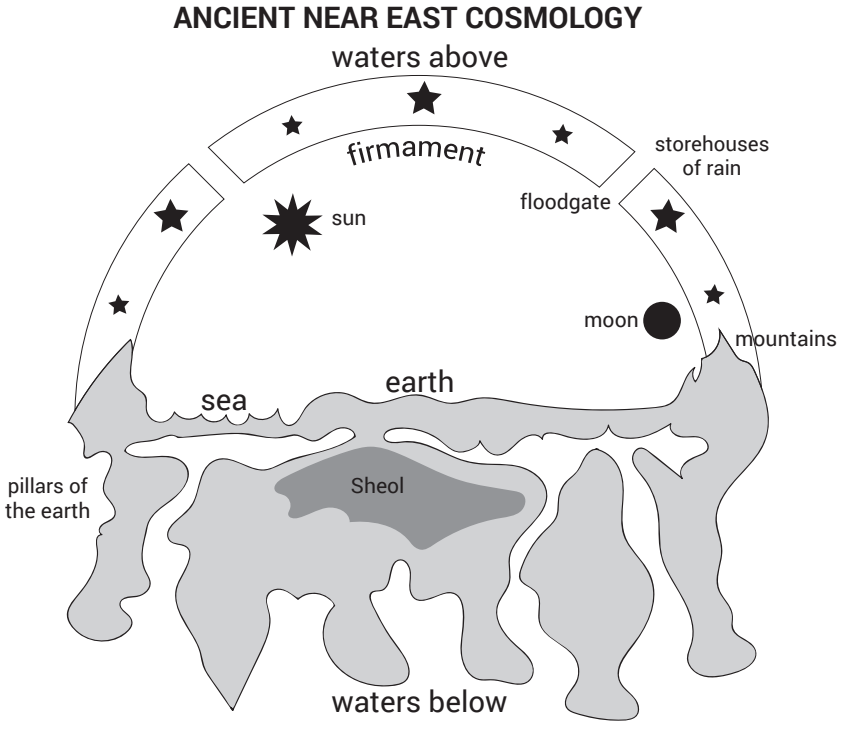

Figure 1. Haarsma's depiction of the 'flat earth, solid sky' cosmology supposedly common to the ancient world (after Haarsma[1])

Are the seven days of Genesis 1 derivative?

If 'ancient cosmology' isn't enough to escape the young-earth implications of Genesis 1, could another aspect of the 'ANE background' provide an escape route? For instance, 'seven' is a common number of significance in both the Bible[8] and the broader ANE literature.[9] Could this mean that the seven-day schema of Genesis 1 is derived from this common usage? If so, the Genesis 1 days are less than historical[10] and not relevant to the earth's age.

The immediate problem for this is that Genesis 1 fronts a narrative that has a clear historical impulse.[11] This

implies the *emphasized* timeframe of Genesis 1 also bears a historical impulse. But is there even enough evidence to establish that Genesis 1 *depends* on this biblical/ANE background for its use of 'seven'?

Sevens in the Bible

Sevens are everywhere in Scripture.[8] But what evidence suggests that the seven-day schema of Genesis 1 was *derived* from this common usage of 'seven'? There is none. In fact, Creation Week was the paradigm for the most significant seven-day schema in the Bible: the Israelite work week:

> "Israel is to keep the Sabbath day holy because (Heb. *ki*) 'in six days the Lord made the heavens and the earth, the sea, and all that is in them, and rested the seventh day … .'
>
> In other words, the Hebrew work week and Sabbath were patterned after the Creation Week, not the other way around."[12]

Nor did the biblical authors have to symbolize God's creative work as a work week to *retroactively* justify the Sabbath. No rationale is ever given for why the Sabbath is day seven in the first recorded command of the Sabbath to Israel in Exodus 16:23. When Moses repeats the Ten Commandments in Deuteronomy 5, he gives a different rationale for the Sabbath unrelated to any 6/7 pattern (Deuteronomy 5:12–15). If obedience to the Sabbath could be justified without reference to any sort of 'seven' in Deuteronomy 5, then God's creative activities need not have been symbolized in Genesis 1 and Exodus 20 with the 'seven' trope in Scripture to retroactively justify obedience to the Sabbath.

Indeed, might not a seven-day Creation Week be the reason for seven's significance in Scripture? If so for the Israelite work week and the Sabbath, why not so for other uses of 'seven'? Any claimed origin for seven's significance in Scripture is bound to be speculative, but at least this suggestion has *some* justification. However, there's no justification for the reverse, that Creation Week was *derived* from the Bible's use of seven.

Sevens in the ANE

Might the seven-day schema of Genesis 1 have been derived from commonality of 'seven' in the broader ANE? The prospects are not good. Even as he attempts to make the ANE context formative for the Genesis 1 use of 'seven', Richard Averbeck still admits of Genesis 1: "There is, however, no other seven-day creation story in the Bible or the ancient Near East."[13] Without direct parallels, the links of Genesis 1 to the broader ANE usage of 'seven' threaten to be too vague to demonstrate dependence or priority.

What does the best evidence we actually have tell us? Two texts regarded as most relevant to Genesis 1 are a seven-day celebration after the god Ningirsu takes up residence in his temple in Lagash in Gudea cylinder 2 (figure 2)[14] and Baal's miraculous construction of a temple through fire in the Ugaritic Baal Cycle.[15,16] They are temple texts, not creation texts, so their relevance depends crucially on the link between temple and cosmos.[17] Weeks has argued that even that link is tenuous.[18] But, even granting a link between temple building and cosmic creation, the specifics of Gudea cylinder 2 and the Baal Cycle still fail to justify the claim that the seven-day schema of Genesis 1 *depends* on this ANE context.

First, the seven-day celebration in Gudea cylinder 2 seems to occur *after* the gods have taken up residence in the temple:

> "Gudea had built the E-ninnu [the temple of Ningirsu], made its powers perfect. … When his master [the god Ningirsu] entered the house, for seven days the slave woman was allowed to became [sic] equal to her mistress and the slave was allowed to walk side by side with his master."[14]

But if so, the seven-day celebration does not relate to the creation or dedication of the temple, and thus it doesn't relate to *cosmic* creation.[19]

The Ugaritic Baal Cycle actually has a temple miraculously *made* in seven days:

> "Then on the seven[th] d[ay],
> The fire went out in the house,
> the f[la]me, in the palace.
> The silver had turned to plates;
> The gold had turned to bricks.

Figure 2. The Gudea Cylinders, which detail the construction of the temple of the Babylonian god Ningirsu (Ninurta) at Lagash (in modern day southern Iraq), dated to around 2100 BC

Mightiest Baal rejoices:
'My house I have built of silver,
My palace of gold.'"[20]

Yet, the Ugaritic material doesn't have any sort of cosmic *origins* narrative.[21] So, why link cosmic *creation* to temple *building* in Ugarit? Weeks is rightly skeptical that this undercuts any historical impulse in the Genesis 1 days:

> "… is this one instance in a Ugaritic text sufficient evidence of the universal ANE mind? There are many cases of the use of seven as a significant number throughout the ANE. The connection of those uses of seven to the biblical usages is a difficult question. The seven days in the Baal text may belong to this general tendency for seven days to appear as a significant period in ANE texts, rather than to a specific connection to temple building."[9]

It's rather pathetic that one must look to accounts like this rather than ANE cosmogonies to establish any links between Genesis 1's use of 'seven' and the ANE context. They have the number seven, but have only a tenuous link to cosmos, let alone cosmic *creation*. But other ANE cosmogonies themselves lack any specific detailed sequential temporal order containing real objects in the natural and biological world like Genesis 1.[22] That seriously undermines any relevance these commonalities have for explaining why Genesis 1 uses a seven-day schema.

And as with the biblical material, we can ask: might not the 6/7 pattern of God's *historical* creation 'work week' ground the commonality of seven's significance in the ANE?[23] However we might answer that question, though, commonalities with the ANE literature don't suffice to establish Genesis 1's dependence on them.

Conclusion

The idea that any supposed 'ancient cosmology' in Genesis 1 is incidental, implying that its timespan is also incidental, does not follow. Just because one 'challenging' element of the narrative is incidental to its main point doesn't mean other 'challenging' elements are. In fact, Genesis 1 emphasizes its timescale. Thus, the '6 + 1'-day schema of Genesis 1 is not an incidental feature of the text, even if the cosmology is. Nor is there enough warrant from the Bible or the wider ANE context to justify claiming that the 'seven days' framework of Genesis 1 depends on this context for its origin. The ANE background is not a 'get out of a young earth free' card.

References

1. A standard presentation of this line of reasoning is found in Haarsma, D.B., Evolutionary Creation; in: Stump, J.B. (Ed.), *Four Views on Creation, Evolution, and Intelligent Design* (Kindle Edition), Zondervan, Grand Rapids, Michigan, pp. 127–131, 2017.
2. Haarsma, ref. 1, pp. 129–130.
3. Haarsma, ref. 1, pp. 130–131.
4. E.g. Holding, J.P., Is the *raqîa'* ('firmament') a solid dome? *J. Creation* **13**(2):44–51, 1999; Holding, J.P., Is the *'erets* (earth) flat? *J. Creation* **14**(3):51–54, 2000.
5. Weeks, N., Problems in interpreting Genesis: Part 1, *Creation* **2**(3):27–32, 1979.
6. Boyd, S.W., Statistical determination of genre in biblical Hebrew: evidence for a historical reading of Genesis 1:1–2:3; in: Vardiman, L. *et al.* (Eds.), *Radioisotopes and the Age of the Earth Vol. II*, ICR, El Cajon, CA, CRS, Chino Valley, AZ, pp. 631–734, 2005.
7. Kay, M., On literary theorists' approach to Genesis 1: Part 2, *J. Creation* **21**(3):93–101, 2007. Kay also showed that the style of repetition in Genesis 1 is indicative of narrative prose, not poetry.
8. Averbeck, R., Chapter One: A Literary Day, Inter-Textual, and Contextual Reading of Genesis 1–2; in: Charles, J.D. (Ed.), *Reading Genesis 1–2: An Evangelical Conversation* (Kindle Edition), Hendrickson Publishers, Peabody, Massachusetts, Kindle location 925–935, 2013.
9. Weeks, N., The Bible and the 'universal' ancient world: a critique of John Walton, *Westminster Theological J.* **78**:1–28, 2016; pp. 18–19.
10. Averbeck, ref. 8, Kindle Locations 726–728, 925–962. Walton, J.H., *Genesis 1 as Ancient Cosmology*, Eisenbrauns, Winona Lake, IN, 2011 argues not that the week is less than historical, but less than *cosmogonic*. This, however, rests entirely on an absurd reading of the 'create' language of Genesis 1 as referring to *proclaiming the functions* of the cosmos rather than *producing* the cosmos. It is a view widely rejected by old-earthers as well as young-earthers. See, for example, the responses of OT scholars Richard Averbeck (old-earther), Todd Beall (young-earther), and C. John Collins (old-earther) to Walton's 'functional origins' view in Charles, J.D. (Ed.), *Reading Genesis 1–2: An evangelical conversation* (Kindle Edition), Hendrickson Publishers, Peabody, MA, Kindle locations 4906–5157, 2013.
11. Cosner, L., Genesis as ancient historical narrative, *J. Creation* **29**(3):121–127, 2015.
12. Beall, T.S.; in: Charles, J.D. (Ed.), *Reading Genesis 1–2: An evangelical conversation* (Kindle Edition), Hendrickson Publishers, Peabody, MA, Kindle locations 1197–1199, 2013.
13. Averbeck, ref. 8, Kindle locations 938–939.
14. The building of Ninĝirsu's temple (Gudea, cylinders A and B), etcsl.orinst.ox.ac.uk/cgi-bin/etcsl.cgi?text=t.2.1.7#, lines 1211–1223, accessed 9 May 2018.
15. Smith, M.S. and Pitard, W.T., *The Ugaratic Baal Cycle*, Brill, Lieden, The Netherlands, p. 83 (CAT 1.4 VI 16–38), 2009.
16. I'm not saying here that, for example, Averbeck and Walton think that the author of Genesis 1 directly borrowed the seven-day pattern from these *texts*. Rather, I'm arguing against the idea that these texts reflect a broader pattern from which the author of Genesis 1 borrowed to come up with its seven-day schema.
17. See e.g. Walton, ref. 10, pp. 100–119.
18. Weeks, ref. 9, p. 12–17.
19. Weeks, ref. 9, p. 18.
20. Smith and Pitard, ref. 15, p. 83: CAT 1.4 VI 31–38.
21. Weeks, ref. 9, p. 8.
22. Weeks, ref. 9, pp. 8–9. See also Adamthwaite, M., Is Genesis 1 just reworked Babylonian myth? *J. Creation* **27**(2):99–104, 2013.
23. Beall, ref. 12, Kindle locations 1188–1203.

Shaun Doyle *obtained a Bachelor of Environmental Science (1st class hons.) and a Graduate Diploma in Natural Resource Studies from the University of Queensland, Brisbane, Australia. He currently works fulltime as an editor, reviewer, and writer for CMI in New Zealand.*

Frontal lobotomies and Darwinism—an example of harm to life and health

Jerry Bergman

The history of the surgical practice called lobotomy today was reviewed. The theory concluded certain undesirable aggressive behaviours were due to the influence of our primitive reptile brain we inherited from our reptile evolutionary ancestors. The solution was an attempt to separate the more primitive brain from the more advanced part of the brain to reduce its influence. The procedure was popular not only in America, Great Britain, and Europe, but also Japan. Although some attempts were successful, in many cases it did more harm than good. Furthermore, the treatment's longevity was disappointing and it had to be replicated, sometimes four or five times. The development of various psychotropic drugs, plus an unacceptable number of failures, forced its abandonment.

The frontal lobotomy procedure was a form of brain surgery based on the evolutionary belief that, as the brain had evolved in primates, the new parts evolved on top of the older brain parts, later called the 'reptile brain'.[1] The term lobotomy is from the Greek *lobos*, meaning lobe (in this case of the brain), and *tomos*, meaning to cut. A frontal lobotomy is thus an attempt to surgically 'cut off' the frontal lobes, especially the very front parts, from the underlying ('less evolved') portions of the brain. It also became known as frontal leukotomy (or leucotomy) from the Greek for 'white', because what was being cut were the connecting fibres between the two, which run in the so-called 'white matter'. (The 'grey matter' in the cortex contains the actual nerve cell nuclei.) The theory was that separating the reptile brain, which was supposedly responsible for 'more primitive' behaviours such as aggression and general emotional behaviour, from the newer brain, the frontal lobes, could reduce such 'reptile' behaviour.[2]

Thus was born the era of surgical lobotomy, which ended only in the late 1960s.[3] In its heyday, "many of the era's most important medical figures—neurosurgeons, neurologists, psychiatrists, physiologists, and others—lent their support" to the procedure.[4] This history illustrates that medicine sometimes drew as much on cultural ideas, such as evolution, as it did on such things as clinical experience, clinical trials, and (animal or laboratory) experimentation.

The history

On 13 September 1848, a 25-year-old railroad worker named Phineas Gage was struck in the head with a 43-inch-long iron tamping bar used to break up rock. The pointed 3 cm (1.25 in) diameter bar was driven completely through his head, destroying much of his brain's left frontal lobe. Specifically, the iron bar entered the left side of his face, continuing upward behind the left eye, through the left side of the brain, and out of the top of the skull through the frontal skull bone. Considering the damage the bar caused, it was amazing Mr Gage survived the accident. The injury's reported effects on his personality and behaviour were dramatic. Overall, he became less aggressive, and far more placid and introverted.[5] In short, he was emotionally flat; both positive and negative emotions had been lost.[6]

A few years later, French surgeon and committed Darwinist Paul Broca (figure 1) concluded, partly on the basis of the famous Gage case, that the prefrontal lobes (the portion at the very front of the frontal lobes) must be the part of the brain that separated humans from lower animals during evolution.[7] Broca was fascinated by evolution and its implications for brain study, and he once remarked: "I would rather be a transformed ape than a degenerate son of Adam."[8,9]

The result of Broca's insight was that researchers on mental illness attempted to surgically separate the parts of the brain that they believed had evolved recently from the parts we had supposedly retained from our ancient reptile ancestors. If Broca and others involved in this history had believed in the creation account that the human brain was created perfect, it is unlikely that they would have concluded that separating sections of it would result in a helpful treatment for the various (post-Fall) problems which they attempted to ameliorate by way of a lobotomy.

The reptilian brain complex

The structures derived from the floor of the human forebrain during early foetal development were labelled as the reptilian brain complex. The term derives from the

Figure 1. Paul Broca (1824–1880) was a major anatomist who specialized in brain research. He discovered the function of what is now called Broca's area, a brain region in the frontal lobe of the dominant hemisphere, usually the left, with functions linked to language.

idea that comparative neuroanatomists once believed that reptile forebrains were dominated by these structures. It was proposed that this 'reptilian brain' was responsible for the instinctual behaviours involved in physical aggression, emotional outbursts, agitation, dominance, territoriality, and, in short, reptile-like personality traits.[10]

One of the first persons to attempt to apply some limited research on the reptilian brain to humans was Professor Gottlieb Burchardt. He did this by attempting to replicate Phineas Gage's accident in six schizophrenia patients confined at the Neuchâtel asylum in Switzerland. Of the six, all whose condition was deemed to be incurable, Burchardt declared the four survivors greatly improved or even cured.[11] He reported the results at a Berlin medical conference in 1889, which influenced others to attempt to replicate his results. Professor Burchardt is now considered the founder of psychosurgery, the use of surgery to treat psychiatric problems.

One person who replicated Burchardt's work was Portuguese surgeon Egas Moniz (1874–1955; figure 2). Moniz attended a talk at the Neurological Congress in London by Yale physiologist John Farquhar Fulton and his psychologist colleague, Carlyle Jacobsen, both professors very familiar with the Gage case. In their talk, they reported on the frontal lobotomies of chimps involving surgically isolating all of the connections between the prefrontal brain lobes and the rest of the brain.[12] Fulton, it seems, was primarily interested not in the treatment of mental illness, but in brain evolution based on the belief that evolution had added newer brain structures to older, more primitive ones later called the reptile brain.[13]

The researchers claimed the surgery made the monkeys calmer, more cooperative, and even passive. Previously they had resisted being restrained, and had exhibited 'frustrational behaviour' if not rewarded due to failing to perform appropriately in various experiments they were forced to endure. But no longer, it seemed, though remaining friendly and alert.[14]

In 1936, from what he learned by reading the work of the Yale professors, including Fulton, Egas Moniz introduced a surgical operation he called prefrontal leucotomy (i.e. cutting of the brain's 'white matter', which represents its connecting fibres), which after his initial experimentations he used in the treatment of schizophrenia and other mental conditions. At this time, no treatment existed that could ameliorate the major symptoms of this baffling disease. The operation, later called prefrontal lobotomy, consisted of incisions that destroyed connections between the prefrontal region and other brain parts. Moniz first tried out the technique on a female patient. He drilled holes in her head, then injected alcohol into the holes to destroy the white fibres connecting the frontal lobes to the rest of the brain.

Moniz concluded the operation was a success, but eventually abandoned the injection technique and instead used a knife to sever the connection between what evolutionists declared was the more evolved frontal cortex and the allegedly primitive brain parts behind it. In 1936, Moniz published his findings in several leading medical journals, and also travelled to London to present his results to the general medical community.

In the words of Donald, Moniz was skilled at "presenting the unpalatable in such a way as to make it attractive" by referring to his "butchery as psychosurgery".[15] Moniz then proceeded to use his crude hacking on a variety of mental patients, all of whom he declared to be improved.[16] As he never did a proper follow-up study on his patients, his claims were at best irresponsible. Today, we realize his patients replaced one set of symptoms for another set. They replaced their aggression and irritability with sluggish, disoriented, even moribund inhibition. Some were reduced to vegetative states, and some died of cerebral haemorrhaging.[17]

Soon, Dr Walter Freeman (figure 3), a physician at St Elizabeth's Hospital in Washington D.C., learned of Moniz's allegedly wonderful results and began his aggressive

campaign to lobotomize in the name of science what turned out to be several thousand Americans. His first victim was Alice Hammatt, who was treated in 1936 after being given the choice of being locked in an asylum for the rest of her life or being lobotomized.

Freeman soon experimented with a faster method to lobotomize, namely to insert an (actual!) ice pick via a few mallet taps through the top of the eye socket, move it around, and thereby sever the connection between part of the frontal cortex and the rest of the brain. This method, called a transorbital lobotomy, was used on thousands of persons by Freeman. Among its advantages was that he did not have to bore a hole through the thick skull bone, but only had to puncture a small hole behind the eyeball where the skull was very thin. All of the previous methods described thus far were not only somewhat crude, but often affected very different parts of the brain. Freeman hoped the transorbital method would lend some consistency to the often very imprecise procedure. Best of all for its enthusiasts,

> "… ice-pick lobotomy could be done by anyone with a strong stomach, and, even better, it could be done anywhere. Freeman carried his ice pick in his pocket, using it on one occasion to perform a lobotomy in a motel room. A cheap outpatient procedure, the ice-pick lobotomy became a common psychosurgical choice in state hospitals across the country."[18]

Freeman's most famous case was 23-year-old Rosemary Kennedy, the oldest sister of former US president John F. Kennedy. She underwent a prefrontal lobotomy in an attempt to control her sometimes extreme emotional outbursts, which may have resulted partly from the family's attempt to control her behaviour. To help her have a more peaceful and productive life, the experts recommended the procedure to her father Joseph. After the surgery, Rosemary was left with the mental capacity of a toddler, unable to walk, form a sentence, or follow simple directions. She was able to relearn some basic skills, but never fully recovered. Instead, the surgery left her mentally and physically incapacitated for the rest of her life.

Lobotomy was used to treat not only the mentally ill, but also the criminally insane, and some claim was even used to 'cure' political dissidents.[19] The use of lobotomies began to decline only in the mid to late 1950s. Although critics of the technique always existed, opposition eventually became fierce because of the many failures and mixed results. Some patients did fairly well, many others did not. Most importantly, phenothiazine-based neuroleptic (anti-psychotic) drugs, such as chlorpromazine, became widely available. These were much more effective than psychosurgery, thus the surgical treatment method was soon superseded by chemical treatment.

Freeman was finally banned from operating only in 1967, after one of his long-term patients died from a brain hemorrhage following her third Freeman lobotomy, and no true lobotomy has been performed in the United States since then. The total number of persons lobotomized by Freeman alone was close to 3,500.[20] During the 1940s and 1950s, lobotomies were performed on close to 50,000 patients in the United States, and around 17,000 in Western Europe, including 4,500 in Sweden.[21,22] Most were women and some were children as young as four.[23] How many of these died prematurely from the operation is unknown, but the number is significant, estimated at 1.5–6 %.[24] Common serious problems included severe hemorrhaging, brain seizures, loss of motor control, partial paralysis, huge weight gains, and intellectual and emotional malfunction.[24] Almost all were seriously affected mentally in some way, some very adversely as was Rosemary Kennedy.

Figure 2. Professor Egas Moniz (1874–1955), a Portuguese neurologist and founder of the psychosurgery field. He invented the technique now called frontal lobotomy, for which he received the Nobel Prize in 1949 for his work in this area.

Amazingly, the 1949 Nobel Prize in Physiology or Medicine was given to Egas Moniz "for his discovery of the therapeutic value of leucotomy in certain psychoses"—a treatment that was considered then as "one of the most important discoveries ever made in psychiatric therapy".[16]

The sometimes-severe adverse effects of the procedure were known from the beginning of the technique's use. Even the early research by the Yale professors reported that their

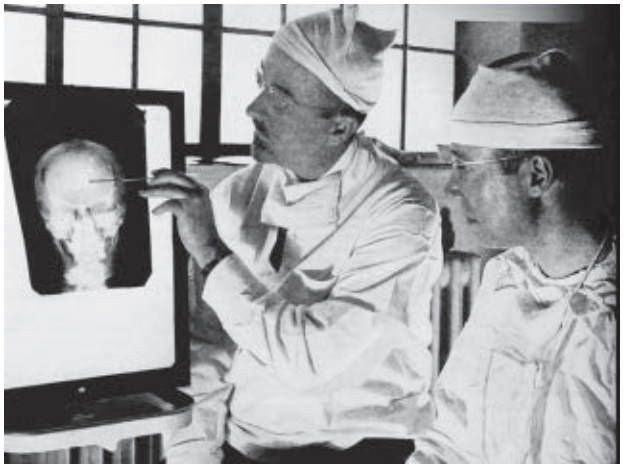

Figure 3. Dr Walter Freeman (1895–1972), left, examining an X-ray before psychosurgery—the cutting of the brain in an attempt to remove 'undesirable aggressive behaviours'.

monkey subjects often lost both ambition and their drive to succeed in the various tasks in which they were involved.

A major reason for eventual growing opposition to the technique, besides the high failure rate and the fact that better chemical treatment techniques became available, was that it did not seem to matter much specifically where or how the cuts in the brain were made. The results were often fairly similar. If there was a reptile brain area that could be separated from the more evolved brain, and if this was the basis for the therapeutic results claimed, the cuts would need to have been made specifically in the area connecting the two. Since it did not seem to matter much where the cuts in the cerebrum were made, this was evidence that was clearly inconsistent with the whole evolution-based concept justifying lobotomy in the first place.

The researchers also found that the positive effects of treatment were often only temporary, and most of the patients relapsed in time, indicating that the damage caused by the treatment was either being repaired or other parts of the brain were taking over those functions lost by the treatment.[25]

Another problem was that the same protocol helped some patients and hurt others. Brain researchers also increasingly concluded that the separate parts of the cerebral cortex are like a symphonic orchestra; each part contributes to the whole, but the music can still sound great even when some parts are missing.[26] In the case of a hemispherectomy (removal of half of the brain, which can sometimes be the only option for severe epileptic seizures), if completed when the patient is young, the remaining hemisphere can largely compensate for the half removed, often with only minor issues with walking.[27,28] Furthermore, children born with only a half or less of the cerebral cortex can almost totally compensate for the loss. This has been documented by twin studies, in which one has a normal brain, and the other has a large percent of the cerebral hemisphere missing.[29]

These observations do not deny that some specific brain parts are critical for certain functions, such as Broca's area being responsible for controlling motor functions involved with speech production. Many patients who have damage to this brain area can generally understand words, but struggle to assemble and express them so as to be able to effectively communicate.

The triune brain

The idea of the 'triune brain' was popular for some time. It proposed that three brain levels existed, the innermost being the reptilian brain, next the palaeo-mammalian complex (the limbic system), and the outer layer was the neo-mammalian complex (the higher-level brain, or neocortex).[30] According to this theory, these structures were sequentially added to the forebrain during the course of evolution.

The brain research noted above on hemispherectomy was critical in demolishing both the triune brain theory and reptile brain theories, as well as the core idea behind the lobotomy procedure. Removal of specific structures, such as by the use of stereotactic surgery with gamma radiation to ablate a cancerous pituitary, is done with a high level of precision to treat a very specific condition. But damage to the cerebrum as done by a lobotomy was often worse than a failure to help improve the patient—the patient was worse off than before the treatment for the reasons noted above.[31]

Other practitioners proposed surgical treatments based on the opposite theory—that the frontal lobes *are* the problem, not the so-called primitive less-evolved brain beneath. Evolutionists contend that humans have the most evolved frontal lobes in the entire animal kingdom, and they reasoned that aggression and other mental problems emanated from these, and so could be ameliorated by separating the frontal lobes from the rest of the brain. This would reduce the influence of the most evolved part of the brain.[32] After all, hadn't Darwin reasoned that humans were one of the most aggressive of all animals?

Outcome

The triune and reptile brain theories lost favour with most comparative neuroscientists in the post-2000 era.[33] The reasons include the fact that efforts to localize the reptile brain failed, and that the hoped-for results of psychosurgery never materialized.[34] Even though the evolutionary assumption was generally retained, it was not surprising that the focus of treatment became success, i.e. health improvements in the sufferers of mental illnesses.[35] Meanwhile, the damage done to countless patients before the procedure was finally abandoned was profound.

Conclusions

The leading scientists involved in the lobotomy procedure accepted evolution, and experimental evidence seemed to show that a part of the brain was important in expressing so-called primitive emotions.

Consequently, their evolution lens on reality predisposed them to conclude that severing certain connections would produce a large reduction in these primitive emotions, and so would in their minds confirm their evolutionary conclusions.

Lobotomy is now only a very embarrassing part of medical history that we can look back on, wondering how and why it was ever largely accepted by both scientists and physicians.[36] Part of the reason was incorrect assumptions about brain evolution. As a result: "Aside from the Nazi doctor Josef Mengele, Walter Freeman ranks as the most scorned physician of the twentieth century."[37]

References

1. Johnson, J., *American Lobotomy: A rhetorical history,* University of Michigan Press, Ann Arbor, MI, pp. 109–110, 2016.
2. Comer, R., *Abnormal Psychology*, Worth Publishers, New York, p. 52, 2013.
3. Faria, M., Violence, mental illness, and the brain—a brief history of psychosurgery: Part 2—From the limbic system and cingulotomy to deep brain stimulation, *Surgical Neurology International* **4**(75), 2013.
4. El-Hai, J., *The Lobotomist: A maverick medical genius and his tragic quest to rid the world of mental illness*, Wiley, New York, p. 4, 2005.
5. Donald, G., *The Accidental Scientist: The role of chance and luck in scientific discovery,* Michael O'Mara Books, London, p. 130, 2017.
6. Fleischman, J., *Phineas Gage: A gruesome but true story about brain science,* Houghton Mifflin, Boston, MA, p. 67, 2002.
7. Valenstein, E., The prefrontal area and psychosurgery; in: *Progress in Brain Research*, vol. 85, chap. 27, pp. 539–554, 1991; p. 540.
8. Sagan, C., *Broca's Brain,* Random House, New York, p. 6, 1979.
9. Brabrook, E.W., Memoir of Paul Broca, *J. Anthropological Institute of Great Britain and Ireland* **10**:242–261, 1881.
10. MacLean, P.D., *The Triune Brain in Evolution: Role in paleocerebral functions,* Springer, New York, 1990.
11. Stone, J.L., Dr Gottlieb Burckhardt—the pioneer of psychosurgery, *J. History of the Neuroscience* **10**(1):80, 2001.
12. Donald, ref. 5, p. 133.
13. Pressman, J.D., Last resort: psychosurgery and the limits of medicine; in: *Cambridge Studies in the History of Medicine*, Cambridge University Press, p. 67, 1998.
14. Valenstein, ref. 7, p. 541.
15. Donald, ref. 5, p. 134.
16. Valenstein, ref. 7, p. 539.
17. Kang, L. and Pedersen, N., *Quackery: A brief history of the worst ways to cure everything,* Workman Publishing, New York, p. 158, 2017.
18. Vertosick, Jr., F.T, Lobotomy's back, discovermagazine.com, 1 October 1997. The article refers to a cautious 1996 trial by Harvard Medical School specialists on 34 patients with totally intractable severe anxiety/depression from a variety of (non-schizophrenic) causes, using MRI guidance to electrically 'fry' a coin-sized area of the frontal lobes. Around one-third of the patients improved significantly.
19. Dain, N., Critics and dissenters: reflections on 'anti-psychiatry' in the United States, *J. History of the Behavioral Sciences* **25**(1):3–15, 1989; | doi:org/10.1002/1520-6696(198901)25:1<3::AID-JHBS2300250102>3.0.CO;2-G; Psychosurgery, Encyclopedia of Mental Disorders, minddisorders.com/Ob-Ps/Psychosurgery.html.
20. Donald, ref. 5, p. 139.
21. Comer, ref. 2, p. 358.
22. The rise & fall of the prefrontal lobotomy, ScienceBlogs, scienceblogs.com/neurophilosophy/2007/07/24/inventing-the-lobotomy, 24 July 2007.
23. El-Hai, ref. 4, pp. 174–175.
24. Comer, ref. 2, p. 453.
25. Valenstein, ref. 7, p. 544.
26. Robbins, J., *The Brain is Like a Symphonic Orchestra*, Grove Press, New York, 2008.
27. Carson, B.S., Javedan S.P., Freeman J.M. *et al*., Hemispherectomy: a hemidecortication approach and review of 52 cases*, J. Neurosurgery* **84**:903–911, 1996.
28. Eileen, P.J. *et al.*, Why would you remove half a brain? The outcome of 58 children after hemispherectomy—the Johns Hopkins experience: 1968 to 1996, *Pediatrics* **100**(2):163–171, 1997.
29. Presentation "Is the Mind What the Brain Does?" by Michael Egnor, M.D., Professor of Neurosurgery at Stony Brook University, presented at the Christian Scientific Society, The University of Pittsburgh, Pittsburgh, PA, 8 April 1017.
30. Harth, E., *Windows on the Mind*, Morrow, New York, p. 116, 1982.
31. Jagannathan, J., Yen, C-P., Pouratian, N., *et al*., Stereotactic radiosurgery for pituitary adenomas: a comprehensive review of indications, techniques and long-term results using the Gamma Knife, *J. Neurooncology* **92**:345–356, 2009.
32. El-Hai, ref. 4, p. 14.
33. Kiverstein, J. and Miller, M., The embodied brain: towards a radical embodied cognitive neuroscience, *Frontiers in Human Neuroscience* **9**(237):1–11, 2015.
34. Donald, G., *When the Earth Was Flat: All the bits of science we got wrong,* Michael O'Mara Books, London, 2012.
35. Franks, D., The neuroscience of emotions; in: *Handbook of the Sociology of Emotions*, Springer, Boston, MA, chap. 2, pp. 49–50, 2006.
36. Kang and Pedersen, ref. 17, pp. 145–150.
37. El-Hai, ref. 4, p. 1.

Jerry Bergman *has nine academic degrees, including five master's and two PhDs. His major areas of study for his graduate work include anatomy and physiology, biology, chemistry, and psychology. He has graduated from Wayne State University in Detroit, Medical University of Ohio in Toledo, University of Toledo and Bowling Green State University. A prolific writer with over a thousand publications to his credit, including 43 books and monographs, Dr Bergman has taught biology, microbiology, anatomy and physiology, chemistry, biochemistry, geology, astronomy and psychology at the college level. Now retired, he has taught at The University of Toledo Medical College, The University of Toledo, Bowling Green State University and other schools for a total of close to 50 years.*

The vomeronasal organ—vestigial or functional?

Jerry Bergman

The history of the vomeronasal organ was reviewed, documenting that the Darwinian doctrine belief has interfered with the drive to understand the function of this important organ in humans. Widely recognized as a functional organ in many animals, its function was assumed to have been lost in humans. Consequently, it was labelled a vestigial organ for many decades. As a result, it was widely touted by evolutionists for over a half century as a useless organ in humans that developed in the embryo, but often deteriorated in adults, thus was an important evidence of evolution. It has now been documented by at least three clinical studies to be a complex system that is critically important in humans. Furthermore, its malfunction can cause disease such as Kallmann's syndrome.

A human organ commonly listed as vestigial is the vomeronasal organ (figure 1). *New Scientist* magazine listed it as the number one example on their list of the five structures humans don't need.[1] One evolutionist wrote, "in spite of some creationist claims, there are genuine vestigial organs and this [the vomeronasal organ] is one of them". As we will document, this conclusion is, at the least, very suspect and likely wrong.

The vomeronasal organ (also called Jacobson's organ, after Ludwig Jacobson, the anatomist who first described it in a paper published in 1811) is a secondary olfactory sensory organ designed to detect pheromones. Pheromones are chemical signals detectable by certain animals. They elicit behavioural, reproductive, and neuroendocrine responses among individuals of the same species.[2] Pheromonal communication is of major importance for many animals to help them manage several aspects of their reproduction cycle.[3]

Often called the sixth sense, the structure is called the vomeronasal organ because it lies close to the two small bones in the nose called the vomer and nasal bones (figure 2). It consists of a patch of sensory cells within a small depression located in the main nasal chamber that detects certain moisture-borne odor particles. Sensitive to a different set of odors than the primary sense of smell, it connects to the mouth through a pair of narrow canals. The system is used by amphibians, reptiles, and even many mammals. Conversely, it was long assumed that 'higher primate' adults lack the vomeronasal organ, the accessory bulbs, and the associated nervous connection to the brain's limbic system.[4] This was assumed because scent marking is not dominant in the so-called higher primates.

Prior to the release of the excellent new detailed research findings discussed below, it was believed the "function and location of the vomeronasal organ in humans remains poorly understood. Indeed, there has been considerable controversy as to whether it even exists" in humans.[5] Nonetheless, the human vomeronasal organ has been a subject of interest in both the scientific literature and "of considerable speculation in the popular science literature".[6]

A common claim was that this organ, although present in human embryos and occasionally found in infants and young children, was less commonly found in adults.[4] Newer studies contradict this, concluding previous studies employing macroscopic observational methods have often missed, or even misidentified, the vomeronasal organ.[7] For example, Trotier *et al.* estimated, of 130 subjects he studied, close to 72% had at least one intact vomeronasal pit, indicating the presence of the organ.[8]

Another study of 27 human septums removed at post mortem were "examined macroscopically, sectioned coronally and examined microscopically. In 70% of these specimens, vomeronasal structures were identified."[9] Won *et al.* found evidence of a vomeronasal organ in almost 60% (13 out of 22) of the cadavers they examined, but others note cadaver research for this very small structure is very problematic.[5] A major problem in this and similar studies is the fact that aging of the human olfactory system commonly results in both loss of both structure and function.[10]

Examination of living subjects has been more fruitful. A study of 410 patients interviewed for plastic surgical procedures detected visible bilateral vomeronasal pits in 93% of the 410 consecutive subjects.[11] The same researchers, using complex modern evaluation techniques, examined 108 fetal specimens, finding every fetus possessed pits leading to prominent vomeronasal organs and "aggregates of nervous terminalis ganglion cells and vomeronasal nerves connecting the vomeronasal organ to the brain".[11] They concluded that

"the vomeronasal system is a universal feature of the adult human nasal cavity".[12]

A third study, of 200 persons, using both macroscopic and microscopic evaluations to complete intranasal clinical examinations, located paired bilateral vomeronasal pits on the anterior of the nasal septum in all of the cases they examined. Furthermore:

> "Biopsies of the vomeronasal pits and surrounding tissues were examined by light and electron microscopy. These studies showed that the vomeronasal pit leads to a closed tube, 2–8 mm long, lined by a unique pseudostratified columnar epithelium unlike any other in the human body."[13]

This study was able to determine much detail about the vomeronasal system, including its nerve connections, using SEM and TEM, which was confirmed by later studies. They also confirmed the presence of "two morphologically distinct cell types in the human vomeronasal epithelium", one of which was of unknown function and which was "unlike any other cell in the human body".[14]

In the largest study involving over 400 adult human subjects, vomeronasal pits were observed "in all individuals except those with pathological conditions affecting the septum".[15] The researchers completed electron microscopy evaluations, finding

> "… two potential receptor elements in the pseudostratified epithelial lining: microvillar cells, and unmyelinated, intraepithelial axons. In addition, unmyelinated axons are common in the *lamina propria* surrounding the organ. They appear to constitute the components essential for a functional chemosensory system, and may thus provide the basis for a pheromone detection system as in other animals."[15]

Some evolutionists, although accepting the conclusion that all healthy humans have a vomeronasal organ, claim it is an evolutionary remnant based on the belief that the genes which code for its cell surface receptors are mutated in many subjects.[16] Neuroscientist Michael Meredith of Florida State University commented to *New Scientist*: "If you look at the anatomy of the structure, you don't see any cells that look like the sensory cells in other mammalian vomeronasal organs", nor do you "see any nerve fibers connecting the organ to the brain".[17] This claim simply indicates the organ is non-functional in humans, but is not evidence it was inherited from a non-human ancestor. It may have had a function in previous generations of human beings and may have a function in today's human adults which we will discover with more research.

As Stoddart concluded, if the putative vomeronasal organ has "any function, and what that might be, must await the outcome of future research".[18] The need to determine its function, if any, is important because

> "… many nasal surgeons are unaware of this organ and its potential physiologic significance… [and] by recognizing its prevalence and location, nasal surgeons will be more likely to identify and possibly preserve this mysterious organ until its function is more clearly understood."[5]

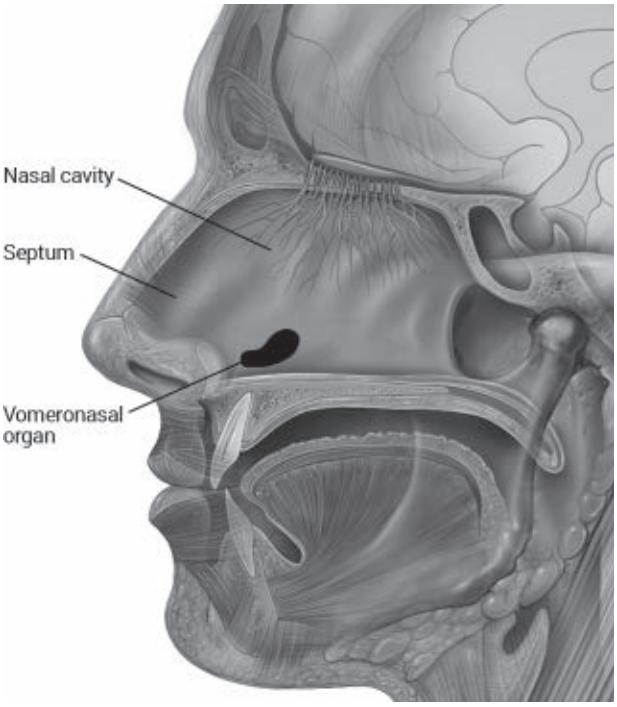

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Figure 1. The vomeronasal organ and other structures of the human peripheral olfactory system.

Research finds several important functions

Other studies have supported Won *et al.*,[7] concluding that the belief that the human vomeronasal organ is "generally considered to be vestigial or non-functional" is incorrect. When steroidal pheromones called vomeropherins are applied to the human vomeronasal organ, many autonomic function changes have been detected, including "pulsatile release of luteinizing and follicle-stimulating hormones, autonomic and electroencephalogram activity".[19]

Thus, researchers concluded their "data demonstrate, for the first time, the existence of a functional vomeronasal-pituitary pathway in adult humans".[19] In addition to the effect on gonadotropin pulsatility, the vomeropherin hormone also produces "decreased respiratory frequency, increased cardiac frequency, and event-related changes of electrodermal activity and EEG pattern", providing "evidence for functional connections between the VNO [vomeronasal organ] and a variety of hypothalamic areas in adult humans".[19]

In one of the most extensive studies on this topic, measurements by the detection system, called

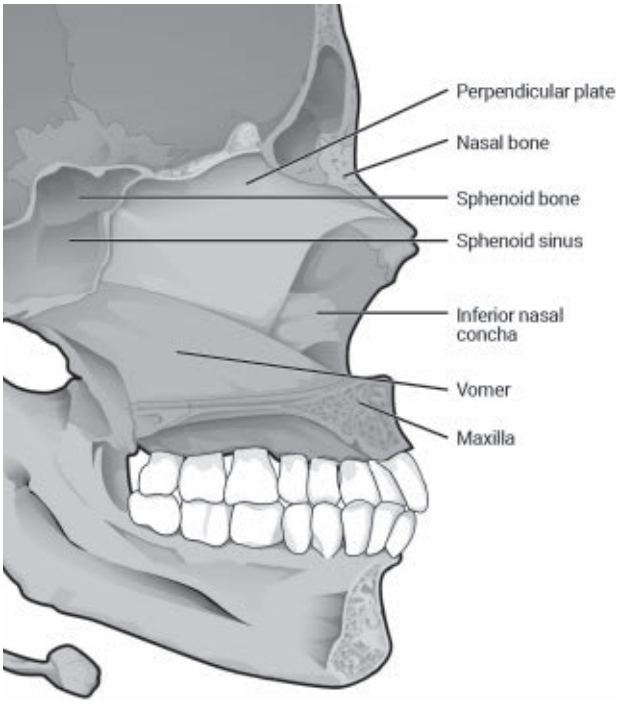

Figure 2. Vomer and nasal bones

electrovomerograms, found the vomeronasal organ's local response included "gender-specific behavioral changes, modulation of autonomic nervous system function, or the release of gonadotropins from the pituitary gland".[20] They used the most sensitive system currently known to measure brain activity, functional brain imaging (fMRI), to reveal that vomeronasal organ stimulation caused "consistent activation of the hypothalamus, amygdala and cingulate gyrus-related structures" in adult humans.[20]

This methodology has effectively dealt with the previous problems in the research on the function of the vomeronasal organ, and powerfully supported the existence of a functional vomeronasal system in adult humans. It is not vestigial but an important functioning system in human adults. An important discovery was that the vomeronasal organ caused gonadotropin-releasing hormone secretion, a role necessary for proper growth and development, and its lack causes disease and malformation of the body.

Monti-Bloch *et al.*, in a review of 86 studies, concluded the human vomeronasal organ "is found as a bilateral structure in all normal human adults", and lack of gonadotropin-releasing hormone cell migration from the vomeronasal organ "to the brain during fetal life results in severe developmental disorders such as in Kallmann's syndrome".[21] Kallmann syndrome is a rare hormonal condition more commonly diagnosed in males characterized by a failure to begin or complete puberty. It is also accompanied by a lack, or highly reduced, sense of smell (anosmia and hyposmia, respectively).

Furthermore, they concluded the careful research using the new technology has shown the "vomeronasal system is functional in the adult human, and is able to mediate autonomic, psychological and endocrine responses". It also shares both "structural and functional properties seen in other mammalian chemoreceptor cells".[22] They also documented that the claim the organ is vestigial by evolutionists has caused researchers to ignore the human vomeronasal organ both in the anatomy, histology, and physiology textbooks and also, tragically, in the research laboratory.[23]

Unfortunately, some studies published after the Monti-Bloch *et al.* study either ignore the studies reviewed above, which find good evidence for a function for the vomeronasal organ, or rely on earlier, cruder studies. Trotier *et al.* write "to our knowledge, the existence of functional vomeranasal receptor neurons that connect to the brain is doubtful in adult humans".[24] This requires replication of the technique used by researchers such as the studies referenced by Monti-Bloch *et al.* review. The most recent review stresses that more research needs to be done to understand this neglected organ and to better deal with the current lack of more detailed research on its function.[16] Watson, who earned his Ph.D. in zoology-ethology under Desmond Morris, has concluded the evidence for vomeronasal function is forcing a revolution in biology which is at odds with those

> "… who want more concrete evidence, preferably from humans willing to have dyes injected into their systems, so that their brains can later be scanned to see where the tracers end up. Such foot dragging in the face of facts has a familiar feel to it. The last time I saw anything like it was in the 1960s when diehard geologists made last-ditch stands against the tide of continental drift."[25]

This is no different than Haeckel's (fraudulent) embryos continuing to appear in the textbooks for many decades after Haeckel was exposed, or results of research that proved the functionality of the appendix and pineal gland taking decades to filter into the biology textbooks.

Research on the vomeronasal organ has now been extended to primates, finding evidence of the organ in New World monkeys, prosimians, and the chimpanzee, which is almost identical to that in the human.[26]

Conclusion

The evidence is now fairly persuasive that the vomeronasal system is not a vestigial organ nor non-functional in adult humans. Rather, it is a critically important system required for proper development and health.[27] Research problems, as well as use of limited techniques, such as visual analysis

and morphological observations rather than experimental evidence, have handicapped past scientists who have attempted to research its many possible functions.

Although much has yet to be learned, when past problems were overcome with new technology, the analysis has enabled researchers to better document the organ's importance in health and life. As one book-length study concluded, the vomeronasal organ is part of "the pheromonal mechanism necessary for … feeding the area of the brain that affects our awareness, emotional states, and sexual behavior".[28] It also likely has several other functions which await more research to determine.

References

1. Spinney, L., Five things humans no longer need, *New Scientist*, newscientist.com/article/dn13927-five-things-humans-no-longer-need/, 19 May 2008.
2. Witt, M and Hummel, T., Vomeronasal versus olfactory epithelium: is there a cellular basis for human vomeronasal perception? *International Review of Cytology* **248**:209–259, 2006; p. 209.
3. Trotier, D. *et al.*, The vomeronasal cavity in adult humans, *Chemical Senses* **25**(4):369–380, 2000; p. 378.
4. Stoddart, M., *The Scented Ape*, Cambridge University Press, New York, p. 37, 1990.
5. Won, J. *et al.*, The vomeronasal organ: an objective anatomic analysis of its prevalence, *Ear, Nose & Throat J.* **79**(8):600–605, 2000; p. 600.
6. Meredith, M., Human vomeronasal organ function: a critical review of best and worst cases, *Chemical Senses* **26**(4):433–445, 2001; chemse.oxfordjournals.org/content/26/4/433.full; Watson, L., *Jacobson's Organ and the Remarkable Nature of Smell*, Norton, New York, 2000.
7. Bhatnagar, K. *et al.*, Number of mitral cells and the bulb volume in the aging human olfactory bulb: a quantitative morphological study, *The Anatomical Record* **218**(1):73–87, 1987.
8. Trotier *et al.*, ref. 3, p. 369.
9. Johnson, A. *et al.*, Clinical and histological evidence for the presence of the vomeronasal (Jacobson's) organ in adult humans, *J. Otolaryngology* **14**(2):71–79, 1985.
10. Bhatnagar, *et al.*, Number of mitral cells and the bulb volume in the aging human olfactory bulb: A quantitative morphological study, *The Anatomical Record* **218**(1):73–87, 1987.
11. Stensaas, L. *et al.*, Ultrastructure of the human vomeronasal organ—part 2, *J. Steroid Biochemistry and Molecular Biology* **39**(4):553–560, 1991; p. 554.
12. Stensaas *et al.*, ref. 11, p. 559.
13. Moran, D. *et al.*, The vomeronasal organ in man: ultrastructure and frequency of occurrence—part 2, *J. Steroid Biochemistry and Molecular Biology* **39**(4):545–552, 1991; p. 545.
14. Moran *et al.*, ref. 13, p. 550–551.
15. Stensass *et al.*, ref. 11, p. 553.
16. D'Aniello, B. *et al.*, The vomeronasal organ: a neglected organ, *Frontiers in Neuroanatomy* **11**, article 70, pp. 1–2, 2017
17. Quoted in Spinney, ref. 1, 2008.
18. Stoddart *et al.*, ref. 4, p. 38.
19. Berliner, D.L. *et al.*, The functionality of the human vomeronasal organ (VNO): evidence for steroid receptors, *J. Steroid Biochemical Molecular Biology* **58**(3):259–265,1996; p. 259.
20. Monti-Bloch, L. *et al.*, The human vomeronasal system: a review, *Annals of the New York Academy of Science* **30**(855):373–389, 1998; p. 373.
21. Monti-Bloch *et al.*, ref. 20, p. 384.
22. Monti-Bloch *et al.*, ref 20, pp. 384–385.
23. Monti-Bloch *et al.*, ref 20, pp. 372–373.
24. Trotier, D., Vomeronasal organ and human pheromones, *European Annals of Otorhinolaryngology, Head and Neck diseases* **128**:184–190, 2011; p. 222.
25. Watson, ref. 6, pp. 9–10.
26. Smith, T. *et al.*, The existence of the vomeronasal organ in postnatal chimpanzees and evidence for its homology with that of humans, *J. Anatomy* **198**:77–82, 2001; p. 77.
27. Bhatnagar, K. and Smith, T., The human vomeronasal organ—III, postnatal development from infancy to the ninth decade, *J. Anatomy* **199**(3):289–302, 2001.
28. Smith, T. *et al.*, ref. 26, From the book jacket.

Jerry Bergman *has nine academic degrees, including five master's and two PhDs. His major areas of study for his graduate work include anatomy and physiology, biology, chemistry, and psychology. He has graduated from Wayne State University in Detroit, Medical University of Ohio in Toledo, University of Toledo and Bowling Green State University. A prolific writer with over a thousand publications to his credit, including 43 books and monographs, Dr Bergman has taught biology, microbiology, anatomy and physiology, chemistry, biochemistry, geology, astronomy and psychology at the college level. Now retired, he has taught at The University of Toledo Medical College, The University of Toledo, Bowling Green State University and other schools for a total of close to 50 years.*

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